TUTE SI RECTE VIXERIS

PHILOSOPHICAL
Tranſactions:
GIVING SOME
ACCOMPT
OF THE
Preſent Undertakings, Studies, and Labours
OF THE
INGENIOUS
IN MANY
CONSIDERABLE PARTS
OF THE
WORLD.

VOL. VI.
For the *Year* 1671.

LONDON,
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Printer to the *Royal-Society*.

BRITISH MUSEUM
NATURAL HISTORY.

TO THE
RIGHT HONOURABLE
ARTHUR
EARL of ANGLESEY

One of the LORDS of His Majeſties moſt Honourable Privy Counſel, *&c.*

My Lord,

YOUR Lordſhips many favours towards me, and mine own engagements to record the modern Reſuſcitations and Advancements of the Philoſophical Sciences, for which you have alwaies ſhew'd a more than Ordinary propenſion, do, in all reſpects, both oblige and encourage me to dedicate this Volume of Philoſophical Tranſactions *to your Lordſhip.*

My Lord, it hath been reported, that Philoſophy and all kinds of polite Literature have commonly retired to the obſcureſt receſſes, for ſhelter from the noiſe of War, and have expired or been almoſt extinguiſht by publick Calamities. But theſe our Generous Philoſophers, whom I have devoted my ſervices to, held out in all the Combuſtions of our former Wars, when our potent Neighbors aſſaulted us on all ſides, and when the Peſtilence and Fire had waſted our Mother City. And they brought in not a few additions of Materials and Aids, to all that had been eſſay'd in former Ages, or had been invented or proſecuted by the modern enterprizes of thoſe admirable Men, our Gilbert, Galilæus, *our Lord* Bacon, Peyreſke, Torricellius, Gaſſendus, Des-Cartes, Harvey, *and many others worthy of everlaſting monuments. Theſe were bright Stars of the firſt magnitude; yet their greateſt Deſigns were lately illuſtrated, enlarged, methodized, and, ſome way or other, improved to more maturity and perfection; as may be ſeen in the* Hiſtory of the R. Society, *and ſometimes more particularly in the* rude Miſcellanies *of theſe Tranſactions.*

So much have the nobleſt Arts flouriſht amongſt us ever ſince His Majeſties moſt auſpicious Reſtauration (partly by the recovery of Antiquities, partly by recent aides, and ſucceſsful Inventions,) even in theſe rougheſt times of publick conflicts, that it may remain for a ſufficient proof, that this Practical Philoſophy is not an effeminate or effete *ſtudy, but efficaciouſly ſerviceable, under the heavieſt incumbrances, as well for the defence of our King and Country againſt hoſtile Invaſions and Encroachments, and for ſupply of neceſſaries for life, health, and ſtrength in War, as for Accommodations, Elegancies and Ornaments in times of Peace and Proſperity.*

'Tis manifeſt, that the Mathematical *and* Mechanical *Arts are no leſs ſeaſonable in theſe our Colliſions, for the skill and ſecurity of Navigation; and for Naval Architecture; for Engins, Fortifications, Artillery, and the modern Tacticks:* Medicine *and* Chirurgery *for the recovery of decayed health, and the healing of loſt or wounded limbs;* Agriculture *for ſuſtenance; and, in remembrance of the old Heroes, I may add Martial* Muſic, *to excite Courage; and other Old and New Inventions proper to furniſh other advantages: Then ſofter Delicacies are fit for treatments, ſatisfactions and political endearments in the eſtabliſhment of ſafe and peaceable Government. An* Archimedes *may as juſtly deſerve applauſe for his ſtout defence of* Syracuſa, *as* Phidias *for the tender touches of his Chiſel in faſhioning the Pourtraitures of Jupiter and Minerva.*

And 'tis by the Intelligent acknowledged, That there are, at this day, a great number of more excellent Artificers, in almoſt all kinds of Works, which are deduced from the Ingenuous Arts, for ſtrength and beauty, and for all neceſſaries and all curioſities, than, I think, were ever before ſeen in England; and that theſe Arts could not have grown ſo ſoon to ſuch height, if his Majeſties extraordinary Magnificence and the Public Exigences had not concurr'd to excite almoſt an Univerſal Induſtry. By the divine conduct, immediately after His Majeſties return, his Countenance and his own great Example in Repairing and Adorning his Royal Palaces, and in ſtrengthning and increaſing his Navy; and his Royal Grant of a Charter to eſtabliſh the Royal Society *(according to* Cicero's *ſentence,* Honos alit artes:) *All theſe encouragements made the way, and prepar'd skilful Maſters and Guides, to ſurvey, direct and promote all ſplendid Structures and Embelliſhments, which are now ſo conſpicuous in the chief places of this Kingdom; and the abundance of goodly Ships, which do now ride in all our navigable Rivers and in all our Seas.*

But I muſt decline a Task too hard for my pen, and too great for my leiſure; and ſhall humbly preſent before your Lordſhips eye a cloſer and ſhorter veiw of ſome particulars contain'd in this ſmall Volume. Aſtronomy, *and other chief parts of the Mathematicks; and a diligent ſearch into the depths of nature, into the nature of Animals, Vegetables, and all Simples, Compounds and Mixtures, were the buſineſs, and in* ſome manner appertain'd to the devotion of the Mighty Monarchs, Patriarchs and Wiſe men of the Eaſt. Here we have an account of ſeveral Novelties in the Heavens, and Changes in the Fixed Stars; the Orbits of the Planets, and the Periods of their rotations, in a ſure way to be aſcertain'd to the minuteſt meaſures of Time and Place. A Comet was ſeen, though but by a few, in the Sping of this Year; Here his appearances and motions are diligently calculated. The Abſtruſities of Mathematicks in ſeveral points rendred eaſie. Brief and eaſie methods of Tangents for many uſes. Algebraical additions, and a Body of Algebra under hand. Muſic open'd Philoſophically, Mathematically and Practically. Opticks gave us the advantage above our Anceſtors for the view of things preſent and at remoteſt diſtance: Here we are offer'd freſh accompliſhments of Opticks and Perſpective; and a Reflecting Teleſcope, which promiſeth and is like to perform more than has hitherto been attained by any approaching proportion of Meaſure. Light and Colors ſhew us all the beauty of this our world: much hath been done lately, with great ſucceſs, to indicate the nature of both, beyond all expectation. And here we have ſecond Adviſes of the nature of both; that Light is not abſolutely pure, but heterogeneous; Whiteneſs not ſimple, but an Aggregate of all Colors. Light reſulting from dead-fleſh, both before it be ſenſibly putrified, and when it is putrified. Here Anatome ſearches near to the Originals of Animal-propagation, and of human contexture; diſſects alſo the Veins of Vegetables, and there finds ſomething analogous to Blood and Sence. Our Scarborough-Spaw is again anatomiſed ſpagyrically: And the Aponenſian Baths of Italy, long ago admired by Livy and Claudian, are here re-examin'd. Common Stones are required to ſhew the Cauſes and Cure of the tormenting Calculus; concerning which here is found an inſtance of one bred under the tongue of a man. The Origin and Virtues of Gems are carefully diſcuſs'd. Chymiſtry is here freed from the ſmuttineſs of ſmoaking vapors, performing much without fire, meerly by curious waies of Digeſtion, Fermentation, and Grinding. The Medicins of beſt note, and tryed, extracted out of 117 Authors, and reduced to an Alphabet of 410 Diſeaſes. Here is a learned Account of the late Plague in London, of the Epidemical and Vernaculous Diſeaſes of England and Wales; the peculiarity of our Air, Soil and Water: Alſo a Work of Chirurgery and Anatome, with a Breviate of the Plague in Holland.

Here Botaniques are diſcriminated, ranged, and explicated by the moſt Eſſential indications of Nature. The Culture of Vegetables appropiated for Orchards by one; and by another enlarg'd from the Flowry Garden to the Common fields and paſtures. New England and *the other Engliſh Plantations in* America *acquaint us with their Vegetables and other rarities, chiefly for Medicine and Chirurgery.* Kermes *found to be in England, and* Cochineil *a kind of Kermes. The dancing Poyſon of the* Tarantula*-Spider and the Muſical cure disbeliev'd in* Otranto *and* Calabria,*their proper places. The manner how the bitings of* Vipers *do poiſon, with great diligence examin'd in Italy; their reſult more than once contradicted in France. The Lake* Lemain,*and the* Rhine *runing through it; ſome Fiſh Cantonizing there, ſome Wanderers, and many remarkables, accurately deſcribed. The* Winds, *in all their guiſes, by Sea and Land traced to their Originals. Prognoſticks, Remedies or Preventions of Dearth and mortalities propos'd. Regiſters of Weather paſt, of price of Corn, human Births and Burials, ſollicited.*

Here are ſome elaborate reſearches made into the Prerogative of Mans Mind; *the pretences to knowledge in* Beaſts; *the Souls of Brutes; the manner of* Senſation,*and* Animation; *into all the curious Motions in nature, perceptive, appetitive, vital. The poyſes of* Gravitation *are here weigh'd in Philoſophical Scales, both relatively and poſitively. The operations, which the varying Weight of the Atmoſphere may have even upon Mens Sickneſs or health, are inquired into.*

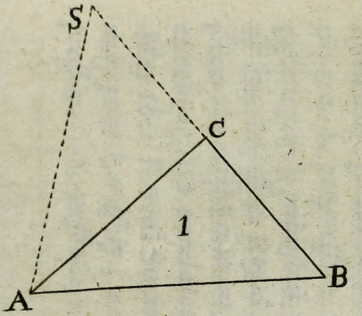
And for Voyages, a Pariſian *hath begun to give us the* fourth *Part of his Collections, relating to the Spaniſh Provinces in* America: *And two* Engliſh *Travellors have enricht us with their Obſervations of the Low-Countries, France, Germany, Helvetia, Griſons, Italy, Sicily, Malta and Spain. General Geography compleated beyond what others were aware of.*

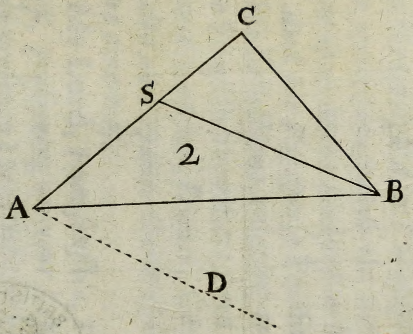
My Lord, *I am ſenſible, I have gone beyond the bounds of an Addreſs, preſuming on your Lordſhips patience, whilſt I endeavor (as in your preſence) to ſatisfie ſuch as are pleas'd to accept of the beſt ſatisfaction I am able to offer, and which is, I think, ſufficient to prove, that knowledge grows on daily, more and more, and that our motion perſeveres to be progreſſive. And your Lordſhip well knows, (and our Regiſters partly publiſh'd, partly reſerv'd, do teſtifie it,) that the Deſigns of his Majeſties Royal Inſtitution receive good aſſiſtance and applauſe from the moſt Eminent in the chief parts of the World, and is either encourag'd or emulated by moſt of the Kings and Princes in Europe. May this* Royal Society, *and the Noble Sciences ever flouriſh; and may your Lordſhip, and all, that favor theſe obliging Deſigns, ever proſper. So wiſheth,* My Lord,

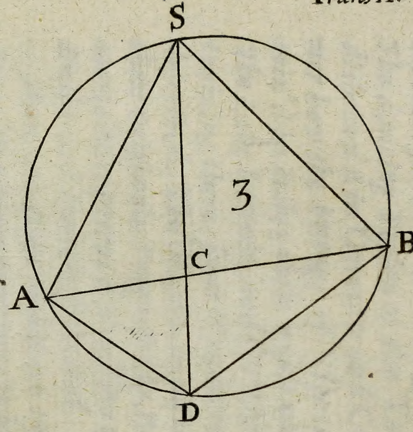
Your Lordſhips
Very humble and obedient Servant,
Henry Oldenburg, Soc.Reg.Secr.

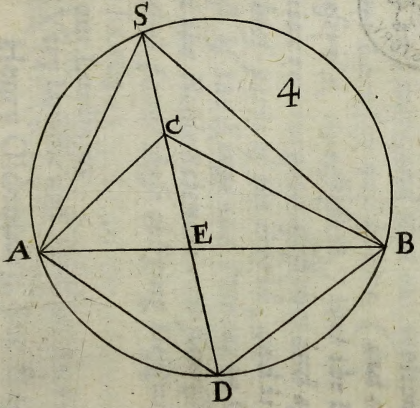
BRITISH MUSEUM NATURAL HISTORY.

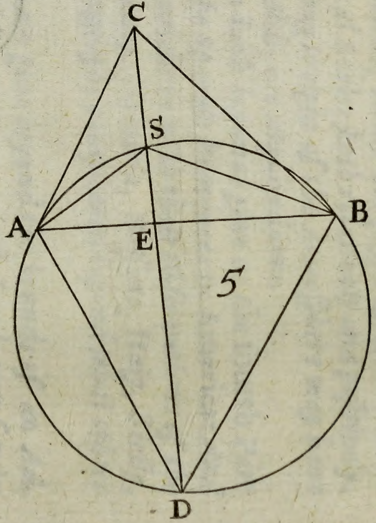
Tab. 1.

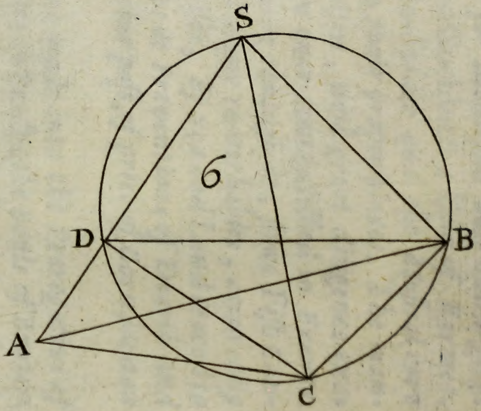












Numb. 69.
Beginning the Seventh Year.

PHILOSOPHICAL TRANSACTIONS.

March 25. 1671.

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A PREFACE

To this *Seventh* years of theſe Tranſactions.

F*Or a Preface to the* Seventh *Year of theſe Tracts, which I am now beginning, I ſhall here recite a few lines taken out of the Concluſion of Mr.* Cowleys Propoſition for the Advancement of Experimental Philoſophy; *where he diſtributes to his Colledge of Philoſophers* their Taſk *in* Four *Branches*: Firſt, *To weigh, examine, and prove all things of Nature,* *deliver'd to Us by former Ages; To detect, explode, and ſtrike a Cenſure through all falſe Monies, with which the World hath been paid and cheated ſo long; And, as I may ſay, to ſet the Mark of the Colledge upon all true Coyns, that they may paſs hereafter without any further tryal.* Secondly, *to recover the loſt Inventions, and, as it were, drown'd Lands of the Ancients.* Thirdly, *To improve all Arts which we now have.* Laſtly, *To diſcover others which we yet have not.* Thus he; *And with great confidence,* That there was never any project thought upon, which deſerves to meet with ſo few Adverſaries as this. For who (*ſaith he*) can without impudent folly oppoſe the Eſtabliſhment of ſuch a Colledge (*ſuch a Society I ſhould ſay*) who make it their buſineſs to ſtudy the Improvement and Advantage of all other Profeſſions, from that of the higheſt General, even to the loweſt Artiſan? Who imploy their time, wit, learning and induſtry to theſe *four* ends, the moſt uſeful that can be imagined.

But in this Expectation Mr. Cowley *was much diſappointed, and deceived. There are ſome, who ſeek all occaſions to diſcourage our Induſtry; to affront and diſparage Experimental Philoſophy and thoſe that contribute their Aydes in it: Sometimes, to render it odious for Novelty, they call it contemptuouſly the* New Philoſophy; *when as yet perhaps themſelves are not ignorant, that 'tis ſo old as to have been the* Diſcipline in Paradiſe; *and from the Firſt of Mankind (who from obſerving the kinds and differences of Animals gave them Names) to have been practiſed and countenanced by the Beſt of Men; Patriarchs and Prophets; oft times with Divine Aſſiſtances and Inſpirations; giving them, that were ſuccesful therein, very eminent attributes of Glory, as in* Noah, Moſes, Solomon, Daniel *and others.*

But let us try theſe Cenſures in Particulars. Is it New Philoſophy, *to inquire diligenty* the things that are; *I mean, To know how the World was made, and the Operation of the Elements; the beginning, ending, and midſt of Times; The Alterations of the Turning of the Sun. and the Change of Seaſons; The Circuit of Years, and the Poſition of Stars; The natures of Living Creatures, the Furies of Wild Beaſts, and the Reaſon-*

ings of Men; the Violence of Winds, and the Motions of the Seas; the diverſities of Plants, and the virtues of Roots; And all ſuch things, as are either Secret or more Manifeſt? For this New Philoſophy *we were diſciplined by the laudable Examples of the moſt Ancient Sages of the* Eaſt. *And we had the ſame or the like Guides (no leſs than the ſame Old Authority) to licence our addiction to the* Mathematicks *and* Mechanicks, *for Military, Civil, or Naval Architecture*; from *the ſoundeſt Foundations of Holy Cities, Temples, Thrones of Wiſdome, Palaces of Glory, and Monumental Pillars,* to *the curious Sculptures and other inſpired Workmanſhip of* Aholiab *and* Bezaleel. *And if Modern diligence hath dived ſo deep, as to find more ſatisfaction in* Atoms, *than in the* three controverted Principles, *will* Diogenes Laertius, *or any other Hiſtorian, or Antiquary, allow theſe Criticks to call the* Atomical *the* New Philoſophy? *Or have our Modern Atomiſts done amiſs in purging the Old Atoms of* Greece *from the Heatheniſh Errors of* Greece?

The next Shift is, to accuſe us of neglecting and deſpiſing all Antiquities. *Yet perhaps they have ſeen the contrary in the* Preface *to the ſecond* Volume *of our* Tranſactions, *where we ſay;* 'Tis our Main buſineſs, as well to retrive all valuable Antiquities, as to ſupply freſh diſcoveries; to recover good Old helps, as to deviſe New. *And how carefully have we (all along) taken notice of the endeavours of the Curious, to revive Old Arts, and to extricate conſiderable Antiquities? This we have done with great reſpects and ſincere veneration. And for this cauſe, in our former* Volumes *we have celebrated* Lambecius, *for his noble undertaking to commemorate the chief Authors and Improvers of all former Arts and Sciences; And* Salmaſius, *for the care he hath taken to find out the Old Medicable Plants, and for the right he hath done* Pliny, *where he deſerved it: And perhaps ſomewhat more might be done for* Pliny, *if, by our Conqueſts, we could enter as deeply, and civilize the* Inlands *of* Africa *and* Aſia, *as, by our late Navigations and Commerce, we have done upon their* Coaſts: *This we are invited to believe by the late Adventures of Maſter* T.S. *when as a Slave he was only employed in a Military Expediti-*

on about the borders of Argiers, (*if it may be credited;*) *And by the Relations of others in their caſual Excurſions elſewhere. And certainly* Pliny *was a perſon of great Induſtry and Knowledge; and might ſometimes (and perhaps too often) receive Incredibilities, becauſe he was at other times convinced of many* improbable *and* ſtrange *Truths, which at firſt ſight ſeemed equally incredible. And as much perhaps may be ſaid for* Herodotus, *who was* rightly *inform'd of ſo many* Orientis Mirabilia (*as* Q. Curtius *calls them*) *that he might be reaſonably tempted to deliver other ſtupendious Relations: And ſome of the ſtrangeſt of theſe may ſeem to be ſomewhat confirm'd or parallel'd in our dayes, by the Remains of the Eaſt in* China, *and by the Prodigies (as I may call them) of* Japan.

The Firſt Man lived a long age, and could not be ſo long idle as not to relate to his Poſterity the Works of God or his Angels (at leaſt for Gardens, Plantations of Vegetables, Flowry Walks, Proſpects, Lands-capes, Arbors, Rocks, Mountains, Fountains, Channels of Rivers, and rich Materials) which he had ſeen in his loſt Paradiſe. The Authentick Monuments of remoteſt Antiquities do make early mention of Gold, *the* Onyx-ſtone *and* Bdellium, *and the Timber* Gopher, (*which ſome gueſſe to be the beſt* Cypreſſe.) *And theſe were ſome of the long-laſting Materials for the Mechanical Arts of Architecture, Sculpture, and other Ornaments. And theſe Long lived Men had need to know laſting Materials, and ſolid work, if they intended to build for their own ſafety, or to leave Monuments for their Poſterity. And, if compared with their Longevity, it was not long after the Deluge of* Noah, *that* Babylon *and* Ninive *bore good teſtimonies to the early growth of Arts.*

Gen. 2. 11,12. c.6.14.

And hence we wiſh an exact ſcrutiny into Old Authors, to give us an accurate Accompt of the Temple of Belus, *the Gardens of* Semiramis, *the Bridge over* Euphrates, *the Walls and Towers in* Babylon *and* Ninive, *and the Obeliskes and other Wonders of the* Aſſyrian *Monarchy: Of the Perſian* Cyrus *his Palace, and the Groves, Orchards, and ſpacious Amænities of the* Medes *and* Perſians: *Of the* Pharos *of* Alexandria; *the* Mauſolæa; *the* Coloſſus *of* Rhodes: *the Image of* Olympick

Jupiter; *the Temple of* Diana, *and other Monuments of* Greece: *Of the* Roman Theaters *and* Amphi-theaters, *their Auguſt and Pompous Structures, Arches, Aquæ-ducts; their Encroachments into the Seas, and their Confinements of the Seas into Saline Lakes by artificial Mountains and diſturbed Rocks: All theſe to be repreſented in ſuch a faithful and punctual manner, as our Engliſh* John Greaves *hath done for the* Pyramids *of* Egypt *and for the Meaſure of the Old* Roman Foot, *and for the Weight of their* Denarius, *compar'd with other Old Meaſures, Weights, and Coyns of greateſt note; both from the oldeſt Records, & from the beſt of later Interpreters. And though we have not the like Remains of the other famous Structures; yet much light may be had by Examining the moſt credible Relations, and by viewing the chief of later Atchievements.*

Others indeed have taken great pains, and have done excellently well both for the Illuſtration of the Old Mechanicks, of the Ark, the Tabernacle, the Temple, and all the Holy Utenſils: And no leſs for the Gentil Magnificence; yet I ought to applaud this late *pattern of* Engliſh *diligence in Doctor* Greaves; *by whom the* Pyramidographia, *the* Roman Foot *and* Denarius *are ſo well traced out, that they may rectifie and aſcertain the Meaſures in other Hiſtorians and Antiquaries for the fore-mentioned purpoſes. And perhaps, if our Northern Monarchs had the ſame power and purpoſe; that prompt Obedience which was the* devoir *of the Old Eaſt; and had ſo many free Votaries for Works of Magnificence, or for Publick Good; and Services ſo cheap, and the Youth ſo ſoon initiated, ſo well diſciplin'd, and ſo ſedulouſly obliged to attend the Ingenious Arts, as when the Wealth of* Grandees *did, in good part, conſiſt in the Number of Slaves; then we might yet think it poſſible in theſe Times, or in following Ages, to raiſe ſuch as would emulate a* Scopas, *a* Cteſiphon, *a* Phidias, *an* Archimedes, *a* Vitruvius, *to gratifie a* Salomon, *a* Cyrus, *or an* Auguſtus. *And if we fail, it is not our fault, but theirs, who by their officiouſneſs would obſtruct our encouraging ſedulity.*

But we may not lay aſide the other expedient, which is ſo helpful to explicate the Old Wonders of Art, and Old Hiſtories of Nature; namely, To inquire diligently The

Wiſd. 7.

things that are; *What Rarities of Nature, and what Inventions of Men are now extant in any parts of the World. And here the* Engliſh *have not been wanting to collect the preſent Teſtimony of theſe later Times from all parts that are yet diſcover'd.* Purchaſe, *by his large and aſſiduous Correſpondence with our Engliſh Merchants, and by other aſſiſtances, did his part ſtrenuouſly, and very uſefully; and hath rather gained than loſt reputation by the greater growth of Experience. Doctor* Heylin, *digeſted into one Volume what he could gather from ſuch credible Authors, as he did beſt underſtand. Mr.* Blome *lately was at an expenſive negotiation to collect into one the beſt Geographical Extracts that he could obtain. And now we have good Expectations from Maſter* Ogilby; *and his* Japan *will forthwith give us a teſt of his diligence and abilities. We ought alſo here to take notice of the* Late Travels *of Sir* Jacomo Baratti, *an Italian Gentleman, into the remote Countries of the Chriſtian* Abyſſines, *or* Æthiopia Interior, *who* (p. 34. *Engliſh) aſſures us of a Large Library there, of above* 10000 *Volumes all in Manuſcripts, ſome of them pretending to the higheſt Antiquities.*

And we are not deſtitute of Linguiſts, who are skilled in their Language. I ſay this only, to excite Generous Spirits to embrace the opportunities of ſearching, what Old Arts or ſound knowledge the Eaſt or other remote parts may afford us. I think we want no other Language but that of China, *to enable our Diſquiſitions even as far as the Riſing of the Sun, and wherever we may expect any old and conſiderable Literature. And if theſe our free Lines can do no other good, yet they will remain for Witneſſes, whether we are Deſpiſers of Antiquities; whether we are not as cheerfully ready to give hearty welcome to the revival and improvement of Olds Arts, as to the Invention of New. For we are well aſſur'd, that Old Wiſdom is much to be preferr'd before newer notions environ'd with endleſs controverſies; though at the ſame time we uſe the freedom of* trying *all, that we may retain what's true and good.*

Thus far I have preſum'd to propoſe our Task; to ſatisfie Objections; to remove Obſtructions; to recommend worthy Authors, and the obliging Induſtry of their ſagacious Expoſitros;

and to repreſent ſome probable ways for the Illuſtration of Ancient Writings. And here I earneſtly implore the Ayde of all the Learned, and the Noble Patrons of Learning, to bring into publick Light the Treaſures of Libraries, before they be ſacrificed to worms and putrefaction; and to examine Herodotus *and* Pliny, Theophraſtus *and* Dioſcorides, *and all the Old Monuments, both with Candour and equal Integrity; to remark what is manifeſtly falſe, or with great reaſon to be ſuſpected; to confirm what may by Parallels be confirmed; and laſtly to ſee what yet further may be added to* Pancirolus, *& what may be thence diſcarded, and what* Succedanea *may be adopted. And now I come a freſh to offer what I have at hand.*

A Solution,

Given by Mr. *John Collins* of a Chorographical Probleme, propoſed by *Richard Townley* Eſq. who doubtleſs hath ſolved the ſame otherwiſe.

Probleme.

The Diſtances of three Objects in the ſame Plain being given, as *A*, *B*, *C*; The Angles made at a fourth Place in the ſame Plain as at *S*, are obſerved: The Diſtances from the Place of Obſervation to the reſpective Objects, are required.

The Probleme hath ſix *Caſes*. See *Tab.* 1.

Caſe 1. IF the Station be taken *without* the Triangle made by the Objects, but in one of the ſides thereof produced, as at *S* in the *firſt* figure: find the Angle *A C B*; then in the Triangle *A C S* all the Angles and the Side *A C* are known, whence *either or both* the Diſtances *S A* or *S C* may be found. Fig. 1.

Caſe 2.

Fig. 2. Caſe 2. If the Station be *in* one of the Sides of the Triangle, as in the *Second* figure at *S*, then having the three ſides *A C*, *C B*, *B A*, given, find the angle *C A B*; then again in the Triangle *S A B* all the Angles, and the ſide *AB* are known, whence may be found either *A S* or *S B*, *Geometrically*, if you make the angle *C A D* equal to the obſerved angle *C S B*, and draw *B S* parallel to *D A*, you determine the Point of Station S.

Fig. 3. Caſe 3. If the three Objects lie in a right Line as *A C B* (Suppoſe it done,) & that a Circle paſſeth through the Station *S*, and the two exteriour Objects *A B*: then is the Angle *A B D* equal to the obſerved angle *A S C* (by 21 of the 3d. book of *Euclid*,) as inſiſting on the ſame Arch *A D*: And the Angle *BAD* in like manner equal to the obſerved Angle *CSB*: By this means the point *D* is determined. Joyn *D C*, and produce the ſame, then a Circle paſſing through the Points *A B D*, interſects *D C*, produced at *S*, the place of Station.

Calculation.

In the Triangle *A B D* all the Angles and the ſide *A B* are known, whence may be found the ſide *A D*.

Then in the Triangle *C A D*, the two Sides *C A* and *A D* are known, and their contained angle *C A D* is known; whence may be found the Angles *C D A* and *A C D*, the complement whereof to a Semicircle is the angle *S C A*: in which Triangle the Angles are now all known and the ſide *A C*: whence may be found either of the Diſtances, *S C* or *S A*.

Fig. 4. Caſe 4. If the Station be *without* the Triangle, made by the Objects, the ſum of the Angles obſerved is leſs than four right Angles. The Conſtruction is the ſame as in the laſt Caſe, and the Calculation likewiſe; ſaving that you muſt make one Operation more, having the three Sides *A C*, *C B*, *B B*, thereby find the angle *C A B*, which add to the Angle *E A D* then you have the two ſides, *viz.* *A C*, being one of the Diſtances, and *A D*, (found as in the former Caſe) with their contained

Angle *C A D* given to find the angles *C D A* and *A C D*, the Complement whereof to a Semicircle is the angle *S C A*: Now in the Triangle *S C A*, the Angle at *C* being found, and at *S* obſerved, and given by Suppoſition, the orher t *A* is likewiſe known, as being the complement of the two former to a Semicircle, and the ſide *A C* given; hence the diſtances *C S* or *A S* may be found.

Caſe 5. If the place of Station be at ſome Point *within* the Plain of the Triangle, made by the three Objects, the Conſtruction and Calculation is the ſame as in the laſt, ſaving only that inſtead of the obſerved Angle *A S C*, the Angle *A B D* is equal to the Complement thereof to a Semicircle, to wit, it is equal to the Angle *A S D*; both of them inſiſting on the ſame Arch *A D*: And in like manner the Angle *B A D* is equal to the Angle *D S B*, which is the Complement of the obſerved *C S B*; and in this Caſe the ſum of the three Angles obſerved, is equal to four right Angles. Fig. 5.

In theſe three latter *Caſes* no uſe is made of the Angle obſerved between the two Objects, as *A* and *B*, that are made the Baſe-line of the Conſtruction; Yet the ſame is of ready uſe for finding the third diſtance or laſt ſide ſought, as in the fourth Scheme, in the Triangle *S A B*, there is given the diſtance *A B*, its oppoſite Angle equal to the ſum of the two obſerved Angles, and the Angle *S A B* attained, as in the fourth Caſe: Hence the third ſide or laſt diſtance *S B* may be found.

And here it may be noted, that the three Angles *C A S*, *A S B*, *S B C*, are together equal to the Angle *A C B*; for, the two Angles *C S B* and *C B S* are equal to *E C B*, as being the Complement of *S C B* to two right Angles; and the like in the Triangle on the other ſide. *Ergo, &c.*

Caſe 6. If the three Objects be *A*, *B*, *C*. and the Station at *S*, as before, it may happen, according to the former Conſtructions, that the Points *C* and *D* may fall cloſe together; and ſo a right Line, joyning them, ſhall be produced with uncertainty; in ſuch caſe the Circle may be conceived Fig. 6.

to

to paſs through the place of Station at *S*, and any two of the Objects (as in the ſixth *Scheme*) through *B* and *C*, wherein making the Angle *D B C* equal to the obſerved Angle *A S C*, and *B C D* equal to the Complement to 180 degrees of both the obſerved Angles in *D S B*; thereby the point *D* is determined, through which, and the points *C*, *B*, the Circle is to be deſcribed, and joyning *D A*, (produced, when need requireth,) where it interſects the Circle, as at *S*, is the place of Station ſought.

This *Probleme* may be of good Uſe for the due Scituation of Sands or Rocks, that are within ſight of three Places upon Land, whoſe diſtances are well known; or for *Chorographical* Uſes, *&c.* Eſpecially now there is a Method of obſerving Angles nicely accurate by ayde of the *Teleſcope*; and was therefore thought fit to be now publiſht, though it be a competent time ſince it was delivered in in writing.

An Accompt

Of ſome Mineral Obſervations touching the Mines *of* Cornwal *and* Devon; *wherein is deſcribed the Art of* Trayning *a* Load; *the Art and Manner of* Digging *the Ore*; *and the Way of* Dreſsing *and of* Blowing Tin: *Communicated by an Inquiſitive perſon, that was much converſant in thoſe Mines.*

FOr the more eaſie apprehending of this Art, it is ſuppoſed;

Firſt, That there hath been a great Concuſſion of waters in that Separation of the waters from the waters mentioned in the Creation, *Gen.* 1. *v.* 9. 10. when the Dry Land firſt appeared; or in *Noahs* Flood; or at both times, whereby the waters moved and removed the (then) Surface of the earth.

Secondly, That before this Concuſſion, the uppermoſt ſurface of Mineral Veins or Loads did (*in moſt places*) lie even with the (then real, but now imaginary) ſurface of the Earth, which is termed by the Miners, the *Shelf*, *Faſt Countrey* or Ground that was never moved in the Flood (ſay they;) whom and whoſe terms, for avoiding of ſuperfluous words and needleſs circumlocutions, I ſhall in theſe following lines repreſent and uſe. I ſaid, *in moſt places*, becauſe they dip in ſome ; as may be collected from the annexed *Scheme* & what ſhall be ſaid anon in the manner of Digging.

Thirdly, That in this Concuſſion of waters the ſurface of the Earth, together with the uppermoſt of thoſe Mineral veins, were then looſed, and torn off, and by the deſcending of the waters into the valleys, both the earth, or *Grewt*, and thoſe mineral ſtones, or fragments, ſo torn off from their Loads (which are conſtantly termed *Shoad*) were together with and by the force of the waters carried beneath their proper places, and from ſome hills even to the bottoms of the neighbouring valleys; And from thence by Land-floods, many miles down the Rivers; in others more or leſs diſtant in the ſides thereof, ſomwhat according to their declivity, and ſomewhat according to the impetuouſneſs of the waters; which, as I conceive, was not in all places alike.

Now theſe three Generals, on which ſeem to depend the grand reaſons of this Art, being ſuppoſed and premiſed, we thus proceed to *Train:*

1. Where we ſuſpect any Mine to be, we diligently ſearch that Hill and Countrey, its ſcituation, the earth, or grewt, its colour, and nature, and what ſort of ſtones it yields; the reaſon hereof being only this, that we may the better know the grewt, and ſtones, when we meet with them at a diſtance in the neighbouring valley; for mineral ſtones may be found 2, 3, 4, 5 miles diſtant from the Hills or Loads, they belong unto.

2. After any great Land-flood (in which it is ſuppoſed there are ſome new frets made in the ſides of the banks,) we go and diligently obſerve ſuch frets (which uſually after ſuch floods are very clean) to ſee, if happily we can diſcover any metalline ſtones in the ſides or bottoms thereof, together with the Caſt of the Countrey (*i. e.* any earth of a different colour from the reſt of the bank) which is a great help to direct us, which ſide or hill to ſearch into. Neither will it be much amiſs in this place to ſubjoyn the few, but ſure, characters of Mineral ſtones, by which we know the kind of metal, and how much it yields. The firſt way

is, by its ponderouſneſs, which eaſily informs us whether it be metal or no. The ſecond is, its poroſity; for moſt Tin-ſtones are porous, not unlike great bones almoſt throughly calcined; yet Tin ſometimes lies in the firmeſt ſtones. The third is, by water, which we term *Vauning*, and that is performed by pulveriſing the ſtone, or clay, or what elſe may be ſuſpected to contain any mineral body, and placing it on a Vauning ſhovel; the gravel remains in the hinder part, and the metal at the point of the ſhovel, whereby the kind, nature and quantity of the Ore is gueſſed at; and indeed moſt commonly without any great deception, eſpecially if the *Vauner* have any judgement at all.

3. But if no *Shoad* may be found or diſcovered in ſuch frets, then we leave that place, neither truſt we to any Metalline ſtones found in the common River, for the reaſon afore-mentioned, and becauſe they rather breed diſtraction, than guide us to the finding out the Load, eſpecially if they are ſmooth, without protuberances, and aſperities, ſuch as are uſual to ſtones newly broken: for then they plainly ſhew they have been brought a great way, and in their tumblings thither are worn ſo ſmooth, as moſt water-ſtones are. Then we go to the ſides of thoſe Hills moſt ſuſpected to have any Loads in them, where there may be a conveniency of bringing a little ſtream of water (the more the better,) and cut a Leat, Gurt, or Trench, about 2 foot over, and as deep as the Shelf, in which we turn the water to run 2 or 3 dayes; by which time the water, by waſhing away the filth from the ſtones, and the looſer parts of the earth, will eaſily diſcover, what Shoad is there. If we find any, we have a certainty of a Load, or at leaſt a *Squatt* in the upper parts of the Hill. *Squatts* are certain diſtinct places in the earth, not running in veins, differing from *Bonnys* (which word will occur by and by,) in this only that *Squatts* are flat, *Bonnys* are roundiſh.

4. Sometimes *Shoad* may be found upon the open ſurface of the ground, as being thruſt up by Moles in their hillock, or turned up by the plow, or by ſome other accident;

dent; for it is ſeldome found on the open ſurface of the ground, unleſs brought thither by an accident ſince the Flood, eſpecially in cultivated places; ſeeing that the corruption of vegetables and other creatures have in the long tract of time begotten a new ſurface, heighten'd in ſome places above a foot, in others more or leſs. And this I have often obſerved, and is eaſily demonſtrable to the eye in every Tin-work.

5. When all theſe wayes have been attempted for finding *Shoad*, if we find any, it makes us proceed with the greater confidence, having an aſſurance of a *Load;* but in caſe we find not any, then we muſt go by gueſs. And here is all the difference as yet between finding and not finding *Shoad*. For in the next place we ſink down about the foot or bottom of the Hill an *Eſſay-hatch* (an orifice made for the ſearch of a vein, about 6 foot long and four foot broad) as deep as the *Shelf*. And it is obſervable, they are always to be as deep as the Shelf for this reaſon, that otherways you may come ſhort of the *Shoad:* But if we meet with none before, or when we come to the *Shelf* or *Faſt-Countrey*, there is none to be expected; yet ſometimes the *Shoad* is waſh'd away clean, when you come within 2 or 3 foot from the *Load*, and then the *Load* is a foot or two farther up in the Hill. If we find any *Shoad* in this firſt *Eſſay-hatch*, our certainty is *either* encreaſed if any Shoad were found before; *or* begun. Neither doth it add a little to make a right conjecture, how high up the Hill, or far off, the *Load*, *String*, or *Bonny* is, carefully to mark how deep from the ſurface of the Earth our *Shoad* lies: for this is held an infallible Rule, that the nigher the *Shoad* lies to the *Shelf*, the nigher the Load is at hand, *& vice verſâ.*

6. Albeit we finde no *Shoad* in this firſt *Hatch*, having found ſome before by the ways afore-mentioned, or having found none, we are not (as yet) altogether diſcouraged; but aſcend commonly about 12 fathom, and ſink a 2d *Hatch*, as the former: And in caſe none appear in this, we go then as many fathom on each hand at the ſame height, and ſink there as before, and ſo aſcend proportionably with 3 or

more Hatches (if the ſpace of ground requires) as it were in breſt, till we come to the top of the Hill, and if we find none in any of theſe *Hatches*, then farewell to that Hill.

7. But if we find any *Shoad* in any of theſe Hatches, we keep our aſcending Hatches in a direct line; and as we draw nearer the *Load*, the deeper the *Shoad* is (as afore) from the ſurface, but the nigher the Shelf; as ſuppoſe it be 7 foot deep, and but half from the Shelf, then we preſently conclude, the *Load* to be within a fathom or 2 of us, and ſo we leſſen our firſt proportion accordingly, as of that of 12 fathom to 6, 4, 2, 1; as our conjecture guides us.

8. Sometimes it falls out, that we may over-ſhoot a *Load*, that is, get the upper ſide of it, and ſo we looſe it; for which we have another (counted alſo infallible) Rule, *viz.* that finding *Shoad* lying near the *Shelf* in this *Hatch*, and finding none in the next aſcending, we have over-ſhot our Load. The remedy is eaſie, which is to ſink nigher the Hatch, wherein we laſt found *Shoad.*

9. At other times it may happen, that we find a new *Shoad*, that is, two different Shoads in one Hatch; as ſuppoſe in this Hatch we find our Shoad 8 foot deep, in the next we hope to find it at 10 foot; but at 2 or 4 we meet with a new Shoad, and Grewt, (which we diligently obſerve;) and at 10 we meet with our firſt Shoad: Then, I ſay, we have a certainty of another *Load* above the former, and it may be in Training up to the ſecond, we meet with the Shoad of a third. Neither is this diſſonant to the opinion and practiſe of the ancient Tinners, who affirm, that 7 Loads may lie parallel to each other in the ſame Hill, but yet one only *Maſter-Load*; the other 6. (3 on each ſide) being the leſſer concomitants. So may 5 lye in like manner: 3 are common, as in the *Scheme.*

10. Every Load has (as it were) a peculiar coloured earth, or grewt about it, which is found likewiſe with the Shoad in a greater quantity, the nearer the Shoad lies to the Load, and ſo leſſened by degrees about a $\frac{1}{4}$ of a miles diſtance; farther then which, that peculiar grewt is never found with the *Shoad.*

11. A Valley may ſo lye, as at the feet of 3 ſeveral hills; and then we may find 3 ſeveral *Deads*, *i. e.* Common earth, or that looſe earth which was moved with the *Shoad* in the Concuſſion, but not contiguous to the Load in its firſt poſition, (which is alſo termed by us the *run of the Countrey*,) with as many different Shoads in the midſt of each. And here the knowledge of the *Caſt of the Countrey*, or each hill, in reſpect of its *Grewt*, will be very neceſſary, for the ſurer training of them one after the other, as they lie in order according to the fore-going rules of *Eſſay-Hatches:* for the uppermoſt will direct you, with which hill to begin firſt.

12. It may be, that after we have trained up the Hill, inſtead of a Load we find nought but a *Bonny*, or *Squat*; which likewiſe have their Shoad, whoſe form is about 2 or 3 fathom long and half as broad; few larger, moſt leſs: which communicates with no other Load, or Vein, neither doth it ſend forth any of its own; but is entire of it ſelf, whoſe extremities terminate without running out into little innumerable ſtrings, not lying within walls, as Loads; although they are in the Shelf, (not moved by the Flood) whoſe ſurface is equal every where with that of the imaginary Shelfy one,and may go down five or ſix fathoms deep, ſome more, ſome leſs, and there terminate; which *Squatts* are conſtantly wrought out with good advantage to the Workers when found; neither is the Tin of the baſer ſort.

13. Although the *Virgula divinatoria* of ſome few (whoſe ſucceſs I am ignorant of) hath been employed for finding the orifice of a propoſed Mine, and ſome more curious ways, as that of Waters, which may be thought to iſſue from ſuch Loads (which I will not deny, but may be a very conſiderable way in finding Cole-pits,) Mineral ſteams, Barrenneſs of ſoyl, and the pitching of Nocturnal Lights on the ſuppoſed orifices of Mines; yet becauſe they are rather nice, than needful, and not ſufficient for what they are urged by ſome, unleſs it be to cauſe the over-curious but unskilful Trainer to deſiſt from a farther ſearch after

what by ſuch fallible curioſities may ſeem not to be, but yet by the before-mentioned, and daily experimented rules may eaſily be diſcovered; I ſhall willingly omit to inſiſt on any of them. Now having by this way once found our Load, we preſently conſult,

The Art and manner of Digging *up the Ore.*

1. The difficulty of this is not conſiderable to that of *Training.* When we have found our *Load,* the laſt Eſſay-hatch looſes or rather exchanges its name for that of a *Tin-ſhaft,* or *Tin-Hatch,* which we ſink down about a fathom, and then leave a little long ſquare place, termed a *Shamble,* and ſo continue ſinking from caſt to caſt, (*i. e.* as high as a man can conveniently throw up the Ore with a ſhovel,) till we find either the Load to grow ſmall, or degenerate into ſome ſort of weed, which are diverſe; as *Mundick,* or *Maxy* (corrupted from *Marchaſite*) of 3 ſorts; white, yellow, and green: *Daze,* white, black, and yellow: *Iremould,* black, and ruſty: *Caul,* red: *Gliſter,* bloud-red, and black. [*See theſe hard names explained below.* N°. 3.]

2. Then we begin to drive either *Weſt* or *Eaſt,* as the goodneſs of the Load, or conveniency of the Hill invite; which we term a *Drift,* 3 foot over, and 7 foot high; ſo as a man may ſtand upright, and work; but in caſe the Load be not broad enough of it ſelf, as ſome are ſcarce ½ foot, then we uſually break down the *Deads,* firſt on the North-ſide of the Load (for the greater conveniency of the right Arm in working,) and then we begin to rip the Load it-ſelf. [By *Deads* here are meant, that part of the Shelf which contains no metal, but encloſeth the Load as a wall between 2 rocks, and not as that, which was mentioned in the Concuſſion, as in *Training.*]

3. That this myſterious underground-way of working, may the eaſier and ſooner be apprehended, be pleaſed to caſt an eye on the annexed *Scheme,* in *Tab. II.* as here, by the *Alphabet,* explicated; which may give ſome information

to thoſe that have not been converſant in Mines.

a a. The Eſſay-Hatches.

b b. The wall which the Shelf makes on both ſides the Load, and the Load ſo walled.

c c. The Bonny's or Squatts.

d d. The ſtrings or little Veins of the greater and leſſer Loads.

e e. All Mundick.

f f. Moſt Tin with its Spar, which places prove all good Tin, if the ſtring *d, b,* happen to be Tin.

g g. All Clay.

h h. Caul; differing both from *Marcaſite* and *Sparr*: it endureth the fire, which *Marcaſite* or *Mundick* doth not. *Sparr* is a flinty ſtone of different colours.

i i. Clay which may hold a quantity of Tin.

k k. Tin; ſuch flexures are commonly well tinned.

l l. Ire-mould and Daze. *Daze* is a kind of glittering ſtone, enduring the fire, ſome ſofter, ſome harder, of different colours.

m m. Tin again.

n n. All Tin.

o o. Clay carrying Mundick.

p p. A Sell-bed of Tin, which is all Tin, and needs no ſtamping as the other, but dry knacking (*i. e.* without a grate or Cock-water, as anon.) 'Tis obſerved, that a Sell-bed hath never any ſtrings iſſuing from it.

q q. The innumerable ſtrings, like little Capillary veins, in which a Load ſometimes in reſpect of its uppermoſt ſurface may be ſaid to terminate and ſtrike out.

r r. The concomitant Loads on each ſide.

s s. That upper part of the Load, which ſeems as though it were cut off in the ſide of one Hill, and to begin again on the oppoſite ſide of the other Hill; which is when the Load dips almoſt perpendicularly for many fathoms together, and may riſe again in the next Hill (wavie-ways) ſo that the load lies not parallel to the ſurface of the earth every where as hinted before. And hence it comes, that we ſometimes loſe our Loads; for otherwiſe it were almoſt impoſſible to loſe them, did they run in a parallel line to the ſurface of the Earth.

t t. The Rivers.

4. Albeit I have divided this *Maſter-load* into ſo many parts, and the ſame is to be imagined concerning the concomitants; yet I would not you ſhould ſuppoſe, that ſuch real diviſions happen all at once in one Load, but may happen in diſtant ones.

5. The Inſtruments commonly uſed in Mines, that ſerve for ripping the *Loads*, and breaking the *Deads*, and landing both the Ore and Deads, are; (1.) A *Beele* or *Corniſh Tubber* (*i. e.* double points) of 8 *l.* or 10 *l.* weight, ſharped at both ends, well ſteeled and holed in the middle. It may laſt in a hard Countrey ½ year, but new pointed every fortnight at leaſt. (2.) A *Sledge*, flat-headed from 10 *l.* to 20 *l.* weight; will laſt about 7 years, new-ordered once a quarter. (3.) *Gadds*, or Wedges of 2 *l.* weight, 4 ſquare, well ſteeled at the point; will laſt a week; 2 or 3 dayes, then ſharpened. (4.) *Ladders*. (5.) *Wheel-barrows*, to carry the Deads and Ore out of the Drifts or *Adits* to the Shambles.

6. The proportion of Men is, 2 Shovelmen, 3 Beele-men, which are as many, as one Drift can contain, without being an hinderance to each other. The Beele-men rip the Deads and Ore; the Shovel-men carry it off, and land it by caſting it up with ſhovels from one ſhamble to another, unleſs it be where we have a *Winder* with two *Keebles* (great buckets made like a barrel with iron hoops, placed juſt over the then termed *Wind Hatch*,) which as one comes up, the other goes down.

7. A great of this skill conſiſteth in the exact knowledge and obſervation of the Loads dipping; for which we have this general rule: That moſt of our Tin-loads, which run from Weſt to Eaſt, conſtantly dip towards the North, ſometimes they under-lye (that is, ſlope down towards the North) 3 foot in 8 perpendicular; which muſt be obſerved for this reaſon, that we may exactly know,

where to ſink an Air-ſhaft, when occaſion requires; yet in the higher Mountains of *Dartmoor* there are ſome conſiderable Loads, which run *North* and *South:* theſe under-ly towards the Eaſt.

8. Four or five Loads may run parallel to each other in the ſame Hill, and yet (which is rare) meet all together in one Hatch, as it were in a knot, (which well tins the place;) and ſo ſeparate again, and keep their former diſtances. Such a knot hath been obſerved, and wrought on *Hingſton*, a known Mineral-*Down* or *Common* in *Cornwal* (within two miles of which particular place I have formerly lived ſome years.)

9. The breadth of *Maſter-loads* may generally be from 3 to 7 foot broad, ſeldome larger; unleſs at certain places, as in the *Scheme* at *ff*; or where ſeveral Loads may chance to make a knot, or ſend forth ſtrings or veins; neither retain they their uſual breadth in all parts: for, they may be 6 foot at *gg*, ſcarce 2 at *kk*; nay ſometimes ſcarce ½ inch over; but that is to be underſtood of ſtrings and the narroweſt places of the concomitant ones.

10. The Load is uſually in an hard (*i. e.* in a Rocky or Shelfy) Countrey, made up of metal, ſpars and other weeds, and as it were all a long a continued Rock; but hath many veins and joints, as we ſpeak; but in ſome ſofter Countries, the Tin may lie in a ſofter conſiſtence, as that of clay in a manner petrified, whereby it may rationally be expected, that they make more ſpeed and ſhew in their Drifts, and the before-cited number of Beele-men imploy more Shovel-men.

11. Concerning Water, we have theſe obſervables; that in moſt places we meet with it at ſome feet deep from the Loady ſurface, in other ſome not at many fathom deep. It runs commonly through the heart of the Load, not in a direct continued Channel, but windingly in and out, inſenſibly through the veins and joints of the Load.

12. When we are come at any depth, and find the waters begin to annoy us, as it quickly will if any be in the

work, we deſcend to the bottom of the Hill, where we have that conveniency, and at the loweſt place begin as little a Driſt, as the conveniency of working or driving will permit (ſcarce half ſo big as that of the Load) on a level, till we come up to our work. And here becomes the uſe of the *Dial* needful, which we term *Plumming* and *Dialling*, (either to know the exact place of the Tinwork, where to bring our *Adit*; or where to ſink to bring down our *Air-ſhaft* even with the deſired place, perpendicularly; or, to know, which way our Load inclines, when any flexures happen;) which is to be perform'd in this manner, *viz.*

13. A ſkilful perſon with an Aſſiſtant, pen, ink, paper, Sun-dial, and long line, after his gueſs of the place above ground, deſcends into the Adit, or work, and there faſteneth the one end of the line to a fixed thing; and then lets the incited Needle reſt, exactly obſerving, at what point it ſtands, with his pen; then he goes farther in the line ſtill faſtened, and at the next flexure in the Adit makes a mark on his line, by knot, or otherwiſe, and ſets his Dial down again, and there likewiſe notes down that point, on which the Needle ſtands, at the ſecond poſition; and ſo proceeds from turning to turning, ſtill marking down the points, and his line, till he comes to the intended place; which performed, and eactly ſet down, he aſcends, and begins at the orifice of the Adit or work, and repeats what he did in the work; brings his firſt knot, or mark in his line to ſuch a place, as the Needle will ſtand at the ſame point it did under-ground at the knot, and ſo proceeds till he come exactly over the intended place in the Mine.

14. But to reminde what I was ſaying of Water, if this conveniency of an Adit may be had, then our water injures us but a little, as long as we keep on that level with the Adit; for we drive not always on one and the ſame level: As for inſtance; At five fathom we make a drift both wayes, and ſinking five fathom more, we make ano-

ther drift at ten fathom, and ſo deep as we pleaſe. Now when we once paſs that level, on which our Adit runs, and the water begins to trouble us, we have this remedy; either with a Winder and keebles, or leathern bags, pumps, or buckets to get it up to the Adit-level, and ſo we are enforced to do to the very top, where we have not the convenience of an Adit, as in plains. Some, but very few, works may be dry.

15. We obſerve, that if we have *Water*, we never want *Air* ſufficient for Reſpiration, and our candles to burn in; but yet this caution muſt be annexed, that in a ſoft looſe quagmire, clayie Countrey, by the falling of the Deads after us, yet not in ſuch meaſure, as totally to ſtop us up, albeit we have water (and it may be too much) yet our Air is rather too copious, or ſo much condenſed, as that it becomes in a manner a damp, and requires an Air-ſhaft for vent; which damps are ſometimes enlarged by working of the *Mundick* with the Ore.

16. In caſe the Countrey be not ſtrong enough (as being over ſoaked with water from above) to ſupport its own weight, we under-prop our Drifts with Stemples, and Wall-plates, placed much like a Carpenters ſquare, on the one ſide, and over head.

This being the moſt uſual way of Digging, and Landing our Ore, we will haſten to give you an Account of

The Manner and Way of Dreſsing *Tinn.*

Although this be the eaſieſt in reſpect of skill and labor, inſomuch that it is commonly the task of the Lads, that are but new beginners; yet I ſhall not ſcruple to ſet it down, together with the deſcription of our Mills, and other neceſſaries, as ſuccinctly and diſtinctly, as I may.

1. After the Ore is landed, and the greater ſtones broken at the top of the Mine by the Shovel men, 'tis brought on horſes to the ſtamping or knocking mills, and unloaded at the head of the Paſs (*i e.* 2 or 3 bottom-boards with 2 ſide-boards ſloping-wiſe,) in which the Ore ſlides down into the Coffer: But that it may not tumble down all at once, there is placed an Hatch nigh the lower end of the Paſs (*i. e.* a thwart-board to keep up the Ore;) beneath that comes in the Cock-water in a trough cut in a long pole, which with the Ores falls down into the Coffer, (*i.e.* a long ſquare box of the firmeſt timber, 3 foot long and 1½ foot over,) wherein the 3 uſual Lifters, placed between 2 ſtrong broad Lones, having 2 braces or thwart-peices on each ſide to keep them ſteady as a frame, with ſtamper-heads, weigh about 30 *lb.* or 40 *lb.* a piece, of iron; which ſerve to break the Ore in the ſaid Coffer: Theſe Lifters about 8 foot long and ½ a foot ſquare of heart-Oak, having as many In-timbers or Guiders between them, are lifted up in order by double the number of Tappets, (faſtened to as many Arms paſſing diametrically through a great beam, turned by an over-ſhoot-water-wheel on 2 boulſters,) which exactly, but eaſily, meet with the tongues ſo placed in the Lifters, as that they quickly ſlide from each other, ſuffering the Lifters to fall with great force on the Ore, thereby breaking it into ſmall ſand, which is waſhed out by the Cock-water through a braſſe grate, holed very thick, placed within 2 iron bars at one end of the Coffer into the *Launder*, (*i e.* a trench cut in the floor, 8 foot long, and 10 foot over,) ſtopt at the other end with a turf, ſo that the waters runs away, and the Ore ſinks to the bottom: which when full, is taken up (*i. e.* emptied) with a Shovel.

And here I muſt beg leave to digreſſe a little, that I may inform you, how we make our Mill go ſome 2 hours or more after we give over our attendance on it. We have a *Tiler* (*i.e.* a long pole,) faſtned without at the one end to the ſlew or ponder (*i. e.* that looſe and laſt part of the trough, that conveys the ſtream to the mill-wheel) and at the other end is tyed a ſhort rope with a tranſverſe ſtick at the end of it, curiouſly, but trap-wayes, hitcht at both ends under two little pins faſtened in the Lones for that purpoſe; there's another pin ſet in one of the Liſters, at ſuch an exact height, as that, if there be no Ore in the Coffer to keep that Liſter high enough, the purpoſed pin in deſcending knocks out the water, carrying it quite over the Mill-wheel; ſo that when the Coffer is emptied, the Mill reſts of its own accord. And this is the invention (about 30 years ſince but now become common in thoſe parts) of one *John Tomes*, then a Lad, but now as skilful and experienced a Tinner, as our parts afford; who even then ſaw the Inconveniency of a Bell then uſed, which (as ſome Jacks) would onely give notice, that the Coffer was empty; yet before they might come to let out the water, the Mill might break it ſelf in pieces, notwithſtanding their attendance; which by this ingenious knack is now ſaved, and the Mill kept from danger. One Wheel may ſupply three or four Coffers, if we will, but then the Grate-holes of the firſt muſt be much larger than the others, and the reſt proportionable; for Tin may be as well too ſmall (for profitable fuſion) as too great.

2. But to return to our full Launder, it is divided into three parts, *i. e.* the Fore-head, the Middle, and the Tails. That Ore which lies in the Fore-head, *i. e.* within 1½ foot of the grate, is the beſt Tin, and is taken up in an heap apart. The Middle and Tails in another, accounted the worſt.

3. The latter heap is thrown out by the Trambling-buddle *i. e.* a long ſquare Tye of Boards, or Slate, about four foot deep, ſix long, and three over; wherein ſtands a man bare-footed with a Trambling-ſhovel in his hand to caſt up the Ore, about an inch thick, on a long ſquare board juſt before him as high as his middle, which is termed the Buddle-head, who dexterouſly with the one edge of his Shovel cuts and divides it long wayes in reſpect of himſelf,

ſelf, about half an inch a ſunder: in which little cuts the water coming gently from the edge of an upper plain board carries away the filth and lighter part of the prepared Ore firſt, and then the Tin immediately after: all falling down into the Buddle, where with his bare foot he ſtrokes and ſmooths it tranſverſly to make the ſurface the plainer, that the water and other heterogeneous matter may without let paſs away the quicker.

4. When this Buddle grows full, we take it up; here diſtinguiſhing again the Fore-head from the Middle and Tails; which are trambled over again: But the Fore-head of this with the Fore-head of the Launder are trambled in a ſecond Buddle (but not different from the firſt) in like manner: The Fore-head of this, being likewiſe ſeparated from the other two parts, is carried to a third, but Drawing, Buddle, whoſe difference from the reſt is only this, that it hath no tye but only a plain ſloping board, whereon 'tis once more waſhed with the Trambling ſhovel, and ſo it new-names the Ore, *Black-Tin*, *i. e.* ſuch as is compleatly ready for the Blowing houſe.

5. We have another more curious way termed *Sizing*, that is, inſtead of a Drawing Buddle, we have an hairen Sieve, through which we ſift, caſting back the remainder in the Sieve into the Tails, and then new-tramble that Ore. After the ſecond trambling we take that Fore-head in the ſecond Buddle, and dilve it (*i.e.* by putting it into a Canvaſs Sieve, which holds water, and in a large Tub of water luſtily ſhake it) ſo that the filth gets over the rim of the Sieve, leaving the Black Tin behind, which is put up into Hogſheads covered, and lockt till the next blowing.

6. The Tails of both Buddles after two or three tramblings are caſt out into the firſt Strake, or Tye, which is a pit purpoſely made to receive them; and what over-ſmall tin elſe may waſh away in trambling. There are commonly three or four of them ſucceſſively, which contain two

ſorts of Tin; the one, which is too ſmall, the other, too great. The latter is new-ground in a Crazemill (in all reſpects like a Greiſt-mill with two ſtones, the upper and the neather,) and after that trambled in order. The former by reaſon of its exceeding ſmalneſs is dreſſed on a *Reck* (provided for that purpoſe, that is, a frame made of boards about three foot and an half broad, and ſix long, which turns upon two iron pegs faſtened in both ends, and the whole placed upon two poſts, ſo that it hangs in an æquilibrium, and may, like a Cradle, be eaſily removed either way) with the ſhovel and water, and made ready fit to be uſed according to

The Manner and Way of Blowing Tinn.

Conceiving it ſufficient to ſay,that our Furnace is no other than an Alman Furnace, I ſhall proceed (only taking notice, that our Lime, though the ſtrongeſt, I ever yet heard of, as being made of the hardeſt Marble, will not endure the fire in our Hearth, but we muſt uſe a particular kind of Clay) to deſcribe a *Tin-kiln*, whoſe ſtructure is four ſquare. At the top is a large Moor-ſtone about 6 foot long, 4 broad; in the middle thereof is an hole made about half a foot diameter. This ſtone ſerves as an head or cover to another like ſtone, placed about a foot beneath it, but is not ſo long by half a foot as the upper, becauſe it muſt not reach the innermoſt or back part of the Wall, which is the open place through which the flame aſcends from a leſſer place below that, where a very ſtrong fire of *furze* is conſtantly made,and another little ſquare hole on the out-ſide, for a purpoſe anon to be mentioned: The fore-part is like a common Oven, and hath ſuch a chimney in the fore-part.

Now when we perceive much Mundick in our *Tin*; (which ſpoils it by making it britly hard, and not malleable) which we eaſily diſcern before knacking (ſome Loads being much peſtered with it, otherſome not at all,) we are neceſſitated to burn away this Weed in this Kiln after this manner. All the Black Tin (brought to the Blowing-houſe in little Canvaſs-bags on Horſes) that is to be burnt, is laid on the top-ſtone (the Kiln being throughly heated before) and, at the hole above-mentioned, caſt down on the ſecond or bottom-ſtone; at the mouth of which ſtands a man with an iron Cole-rake, to give notice, when enough is let down to cover the ſtone all over about three or four inches thick, which he performs with his rake: The hole at the top is immediatly covered with green turffs, that the flame may reverberate the ſtronger. The Rake-man, after this, conſtantly moves the Tin with his Rake, that all parts of the Mundick may get uppermoſt of the Tin, and ſo be burned away; which we certainly know by this, that then the flame will become yellow (as uſual) and the ſtench leſſened; for whil'ſt the Mundick burns, the flame is exceeding blew. Then with his Rake he thruſts it down, at the open place behind, into the open fire, and then receives a new ſupply of Tin from above, as before. Now when the place beneath, where the fire is made, grows full of Tin, Coals, and Aſhes, with his Rake he draws it forth with the Coals on the mentioned little ſquare hole on the one ſide, near the back, where the Ore (fiery hot and red) lies in the open Air to cool; which will ſcarce be in three dayes, becauſe of the Coals that lye hid in it: But in caſe we cannot ſtay ſo long, then we quench it with water, and is like morter. Albeit we let it cool of it ſelf, or with water, we muſt new tramble it or waſh it (as before) before we put it into the Alman furnace. And becauſe I have ſet down the proportions of Ore and Fire already in the Anſwers to the Mineral Queries, I will not repeat them here, but only add an obſervation or two, and then diſmiſs this ſubject. Moor-Tin (*i. e.* ſuch as is digged up in the Moors) we find runs or melts beſt with Moor-coal, chark't: But our Tin, which lyes in the Countrey, runs beſt with an equal proportion of all Char-coal, and Peate (*i. e.* Moor-coals) for the firſt running; but when we come to remelt our Slags, then we uſe Char-coal. When all is melted down and remelted, there ſometimes remains a different Slag in the bottome of the Float, which we term *Mount-Egge*; And that it is moſtly an iron body, though of a Tin-colour, I accidentally aſſured my ſelf by applying one of the Poles of a Loadſtone to it, which quickly attracted it, yet not ſuch a quantity by far, as that of Iron.

AN
ACCOMPT
OF
TWO BOOKS.

I.

PRODROMO overo Saggio di alcune Inventioni nuove premeſſo all *ARTE MAESTRA* di P. *Franciſco Lana* della Campagnia di Jeſu, in *Breſcia*, 1670. in 4°.

THis Introduction is premiſed to a Work , deſigned by the Author to ſhew the Valuableneſs of the Principles and Knowledg of Natural Philoſophy, by ſome of the more conſiderable Inventions and Experiments hitherto found in Authors, and other new ones of this Writer himſelf; who having in his *Preface* with much freedom repreſented and animadverted upon the Errors committed by thoſe , that have and do treat of Natural Philoſophy, and inſiſted much upon the Lord *Bacon* (though not named) his method and way of Philoſophiſing, giveth us in this *Prodromus* an *Eſſay* of ſome (by him eſteemed uſeful) Diſcoveries and Practiſes, for which we are obliged to Philoſophy. Of the many particulars, he reckons up and diſcourſes of in this Fore-runner, we ſhall only recite one, and recommend it to the trial of the Curious; which is a *Way to make any Flowers or Fruits grow without Seed;* and which our Author deſcribeth, as follows.

I took (ſaith he) a quantity of Orange-flowers, and put them into half a pound of Oyl of ſweet Almonds, together with a little Rock-allom, and ſo incloſed all in a glaſs-flask; which being well ſtopp'd, I expos'd to the Sun for a Month, adding ſtill more flowers, when I found the firſt were putrified, yet without taking theſe out. A Month being paſs'd, I powr'd out the Oyl, impregnated with the vertue of thoſe flowers and very odoriferous, into ſeveral Glaſs-Vials, and carefully ſet them aſide, leaving them untouch'd till the next Spring; at which time looking upon theſe Vials, I obſerved within them certain *Flowers* ſwimming in the Oyl, which to me appear'd not at all different from true and freſh Leaves and Flowers of the Orange-Tree. But the wonder encreaſed ſome Months after, when the hot ſeaſon being advanced, the Flowers were turned into *Fruit* about the ſame time that ſuch fruit was ripen'd upon the Tree; there being ſeen at the bottom of the Vials ſome ſmall Oranges with their proper colour, together with thoſe ſmall ſpecks, which that fruit uſeth to have; ſo that they were in nothing diſtinguiſhable from true Oranges, their ſmalneſs excepted.

There are many (*ſo he goes on*) in the Colledge of *Rome* whom I might alledge as Witneſſes of this curious *Metamorphoſis*, but one ſhall ſerve for all, and that is his Excellency Signior *Innocentio Conti*, now Lieutenant General of the Army of the Church, whoſe high Extraction, rare Valour, and ſublime Wit and Knowledge, have been alwayes admired by me. He was pleas'd to accept of one of theſe Vials from my hands, in which every year hitherto, in the ſeaſon of the Bloſſoming of Oranges, ſuch Flowers are ſeen, which at the time of the ripeneſs of the Fruit are alſo tranſformed into Fruit.

II.

Joh. Henr. Meibomii de *CEREVISIIS*, potibúſque & ebriaminibus extra Vinum aliis Commentarius, annexo libello *Turnebi* de *Vino*. Helmeſtadii 1668. in 4°.

THe Publiſher of this *Commentary*, (but lately come to our knowledge) who is the Son of its Author, renders in the Preface a reaſon, why afrer ſo many Books, formerly publiſh'd on the ſame ſubject, by *Gazius*, *Grataʒrolus*, *Haggecius*, *Schookius*, &c. he would yet publiſh this alſo: In the doing of which he alledgeth, that theſe Authors having only a Medical aim, did meerly examine the nature and quality of thoſe ſorts of Bier, which are *now* in uſe; but that this Writer ſearcheth and relateth from remoteſt Antiquity all kinds of drinks, uſed by all ſorts of Nations, and compareth them with the Modern drinks; diſcourſing of their Uſe only by the by.

This done he diſcourſeth out of Authors, how and by whom, after the firſt uſe of *Water* and *Milk*, were introduced the drinks made out of *Vegetables*; as the Vine, Barley, Wheat, Maiz, Millet, Oats, Rice, Apples, Pears, Pomegranates; and the various Juyces tapped out of Trees, as the Palm, Birch, Sycamore, Maple, and many more. To which he adds thoſe drinks, that are prepared out of *Roots*, *Berries*, *Sugar*, and *Sugar Canes*, and the like. Then he proceeds to that luſcious drink, which is made out of that Animal ſubſtance *Hony*, called *Meath*, and found mention'd in ſome of the moſt ancient Writers, amongſt whom he citeth *Orpheus*;

Ἔυ τε ἄν δὴ μιν ἴδηαι ὑπὸ δρυσὶν ὑψικόμοισιν
Ἔργοισι μεθύοντα μελισσάων ἐριβόμβων
Δῆσον ——

Poſtquam igitur cernes ipſum ſub quercubus altis
Depoſitum, Succo ex Apibus mox vincula membris
Injice ——

Which relateth to the Fable, in which the *Night* is repreſented to have counſelled *Jupiter*, deſigning to dethrone and caſtrate his father *Saturn*, that he ſhould by making him drunk with *Meath*, caſt him into a deep ſleep, and ſo do with him what he pleaſed.

To theſe he ſubjoyneth many intoxicating Drinks, made with narcotick and other hearbs; as alſo the various ſtupifying Fumes, among which *Tobacco* is now ſo famous and common; to which he applieth what *Virgil* ſings of *Caco*;

Faucibus ingentem fumum, mirabile dictu,
Evomit, involvitque domum caligine cæcâ,
Proſpectum eripiens oculis, glomerátque ſub auras
Fumiferam noctem, commiſtis igne tenebris.

He concludeth all with the modern various wayes of *Brewing Bier*; of which ſee the *Diſcourſe* it ſelf.

The annexed *Tract* of *Turnebus* is both elegant, and conſiderable for the Obſervations therein alledged, to ſhew the noxious effects of *Wine* in thoſe people, that drink much of that liquor; preferring good Water, Milk, Bier, and eſpecially good Cider, far above it; and taking notice, that Wine-drinkers have generally more deform'd, lower and drier bodies, as alſo ſhaking limbs, and a more haſty decay of ſight, than others.

Errata.

IN *Numb.* 68. p. 2081. l. 10. r. *Chylous Vrine.* In the Index annexed to *Numb.* 68. add at the very end of the particulars, liſted under the Letter *M*, after the word *Reſtitution*, theſe two numbers, 67. 2058.

In this *Numb.* 69. p. 2090. l. 15. r. *or his Angels.* p. 2092. l. 8. r. *Experience. Doctor.* p. 2095. l. 4. *other at A.*

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Tab. 2.

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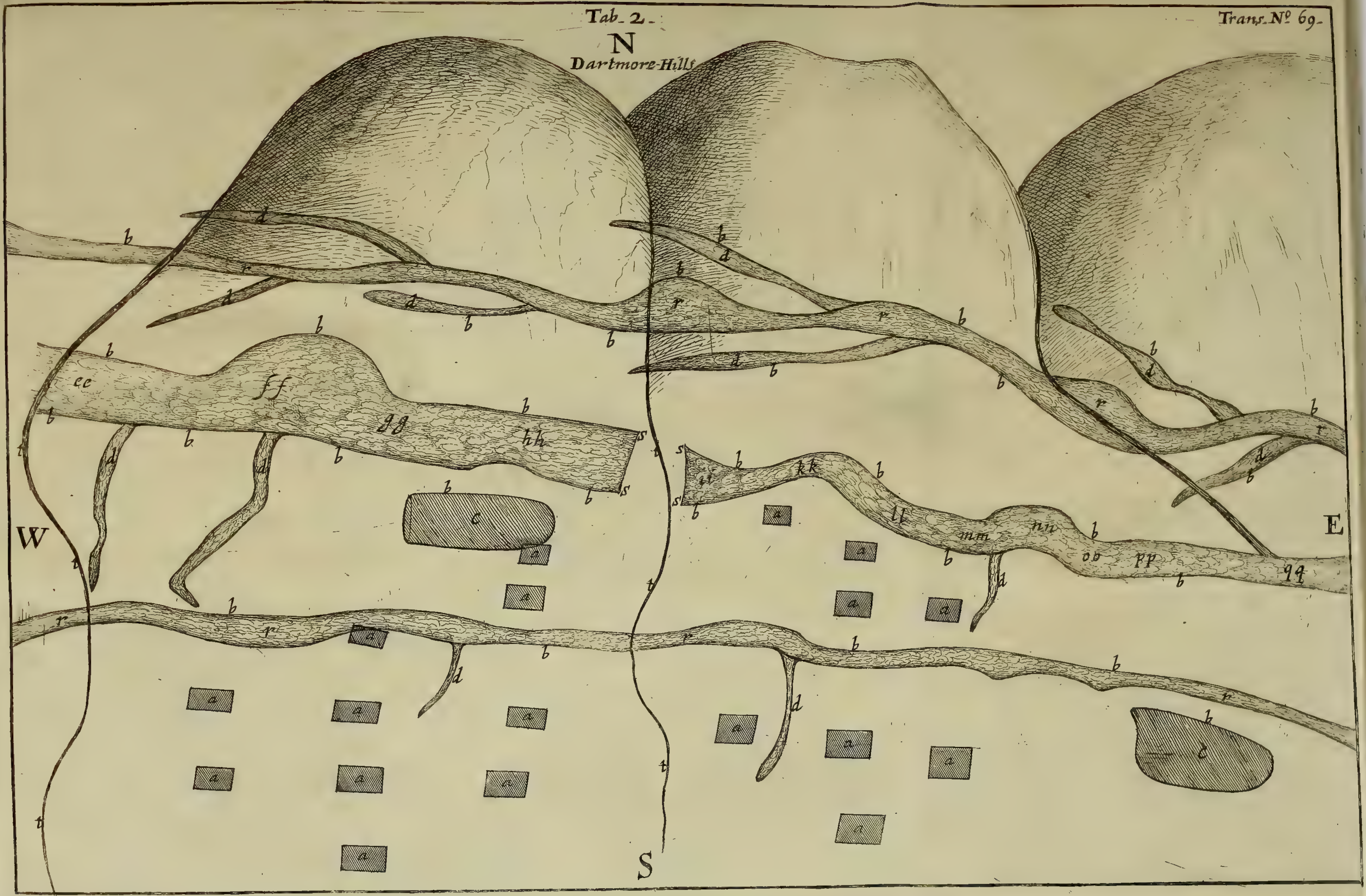

Numb. 70.

PHILOSOPHICAL TRANSACTIONS.

April, 17. 1671.

The CONTENTS.

Extracts of ſeveral Letters, containing ſundry Inquiries and Experiments about the Bleeding of Trees, eſpecially by the warmth of the Fire; the Circulation of Sap in Trees; the Conſiſtence and Quantity of Sap in the reſpective parts of a Vegetable; and the Communication of one part of a Plant with another, in relation to the Aſcent and Deſcent of Sap, &c. *Some Communications concerning Cyder; and the ſeaſon of Tranſplanting. Obſervations touching Colours, in order to the Increaſe of Dyes, and the Fixation of Colours. An Accompt of ſome Books.* I. Theodori Kerckringii *M. D. ANTHROPOGENIÆ ICHNOGRAPHIA.* II. *PHILOSOPHIA VETERUM, é mente RENATI DESCARTES breviter digeſta, ab* Antonio le Grand. II. *TRAITE DE PHYSIQUE par* Jaques Rohault. IV. *Novæ Hypotheſeos de PULMONUM MOTU & RESPIRATIONIS uſu Specimen.*

Extracts of divers Letters, Written by Martin Liſter *Eſquire, to the Publiſher; Touching ſome Inquiries and Experiments of the* Motion of Sap *in Trees, and relating to the Queſtion of the* Circulation *of the ſame.*

1. *Januar.* 28. 167$\frac{0}{1}$. *York.*

YOu may be pleaſed to put this *Quærie* alſo, concerning the Bleeding of the *Sycamore:* What condition the Soil is of, where ſuch Trees are planted, that ſhall either bleed, or refuſe to do ſo: whether Sandy, as that of *Nottingham*, or a wet Clay, as that of the two Trees, I have obſerved here at *York*. *

* Of both which, ſee this *Obſervers* Experiments formerly communicated, *No.* 68. p. 2067, 2608.

2. *Febr.* 8. 167$\frac{0}{1}$. *York*.

Concerning the Bleeding of the *Sycamore*, be pleaſed that I acquaint you with the following Experiment of very late date. The firſt inſtant it froze, the wind at North; the Froſt and Wind continued (ſome little Snow now and then falling) the 2d, 3d, 4th, 5th, 6th, until the 7th in the morning, when the wind came about to the South-Eaſt, and the weather broke up a pace, the *Sycamores* bled not all this while; but the ſeventh about noon, all Trees of that kinde bled very freely both at the Twigs and Body, and I ſtruck above a dozen.

At this ſame Critical ſeaſon, I was willing to repeat the Experiment upon other Trees, and to this end I forthwith ſtruck the *Haw-thorn*, *Hazel*, *Wild-Roſe*, *Gooſeberry-Buſh*, *Apple Tree*, *Cherry-Tree*, *Blather-Nut*, *Apricock*, *Cherry-lawrel*, *Vine*, *Wal-nut*; yet none bled but the laſt nam'd, and that but faintly in compariſon of the *Sycamore*. This is conſonant to our former Experiments: And if it did happen, as I ſaid in one of my former Letters *, that theſe *Sycamores* bled not all this Winter afore at the wounds made the firſt of *November*, I do now think, that if new wounds had been ſtill made at every breach of Froſt, ſome ſignes at leaſt of our *York-ſhire* bleeding *, might have been diſcovered before now: But I affirm no more than I have ſeen and tried.

* See *No* 68. *p.* 2068.

* See the ground for this di-diſtinction in the ſame *Numb.* 68. *p.* 2067, 2068.

In all the Monuments of the Ancients, collected by the great induſtry of *Pliny*, I finde but few inſtances of this nature. Amongſt thoſe few there is one, that is regiſtred with two or three remarkable circumſtances to our purpoſe. He tells us, that the *Phyſicians* of old, when they had a mind a mind to draw the juyce of the *Mulberry-tree*, were wont to ſtrike it skin-deep only, and that about two hours after Sun-riſe. This Experiment is twice mention'd by him, and in both places as a ſtrange *Phænomenon*. We might make our Comment upon thoſe places, but for this time are content only to tranſcribe the Texts. *Lib.* 16. *cap.* 38. *Mirum, hic (cortex) in Moro, Medicis ſuccum quærentibus, ferè horâ diei ſecundâ, lapide incuſſus manat, altius fractus ſiccus videtur.* Lib. 23. c. 7. *Mora in Ægypto & Cypro ſui generis, ut diximus, largo ſucco abundant, ſummo cortice deſquamato; altiore plagâ ſiccantur, mirabili naturâ.*

3. *Febr.* 15. $167\frac{0}{1}$. *York.*

To continue our Experiments concerning the motion of the Sap in Trees; *Febr.* 11th, all was here cover'd with a white Froſt betwixt 9 and 11 in the morning. The weather changing I made the Experiments, which follow, upon the *Sycamore*, *Walnut*, *Maple*. A twig cut aſunder would bleed very freely from that part remaining to the Tree; and, for the part ſeparated, it would be altogether dry and ſhew no ſigns of moiſture, although we held it ſome prety time with the cut end downwards; But, if this ſeparated twig was never ſo little tipp'd with a knife at the other end, it would forthwith ſhew moiſture at both ends. The ſame day, late in the after-noon, the weather very open and warm, a Twig cut off in like manner as in the morning, would ſhew no moiſture at all from any part. Theſe Experiments we repeated very many times with conſtant and like ſucceſs on all the Trees above-mentioned. I enter'd this Experiment with theſe *Quæries* for the next opportunity. 1. Whether a Twig, or the ſmall part of a Root cut aſunder, will not bleed faſter, upon the breaking up of a Froſt, from the part remaining to the Tree, than from the part ſeparated; and whether the part ſeparated will bleed at all, and ſhew no more ſignes of moiſture, than a Twig cut from the top of the Tree, unleſs that ſmall Root be likewiſe cut off at the other end alſo? 2. Whether when it ſhall happen, that a *Sycamore* ſhall be found to bleed upon the ſetting in of a great Froſt, the top twigs and ſmall roots will not both of them bleed freelier from the parts ſeparated, in proportion to their bigneſs? 3. And if it ſhall not ſo prove in the Tryal, that in cold weather the Sap moves *inwards* from Root and Branch to the Trunk, and that upon the breaking of a Froſt, the Sap moves *outward* from the Trunk to the extremities of both Root and Branch; I ſay, if this prove not ſo, whether there be any different motions of Sap at a time in the divers parts of one and the ſame Tree; and where ſuch motions of Sap begin, and whither they tend? 4 Whether the Sap, when it will run, moves longer in the Branches than in the Roots; or whether it begin not to move in all parts of a Tree at a time, and reſt every where at a time? 5. When it reſts, whether it retires to the Body of the Tree, from the Roots and Branches, or ſinks down to the Root, or is any way ſpent by inſenſible ſteams, or is quiet and lodged in every part of the Tree in proportion?

I ſhall long to hear the ſucceſs of your Experiments in the Queſtion of the *Circulation* of the Sap. I have many years been inclin'd to think, that there is ſome ſuch motion in the Juyces of Vegetables. The reaſons which induced me, are; 1. Becauſe I finde, that all the Juyce of a Plant is not extravaſate and looſe, and like Water in a Spunge; but that there are apparent Veſſels in Plants, analagous to Veins in Animals: which thing is moſt conſpicuous and clear in ſuch Plants, whoſe Juyce is either White or Red, or Saffron-colour'd; for inſtance, in each kind of Juyce we propoſe *Lactuca*, *Atractilis*, *Chelidonium majus*. 2. Becauſe that there are very many Plants (and theſe laſt named are of the number) whoſe Juyce ſeems never to be at reſt, but will ſpring at all times freely, as the Blood of Animals, upon Inciſion.

The way of Ligature by Metalline Rings, by you mention'd, is an Expedient I have not uſed; but other Ligatures I have, upon a great number of our Engliſh Plants, not without the diſcovery of many curious *Phænomena*. The ſucceſs of an Experiment of this Nature upon *Cataputia minor Lobel.* was as followes: I tied a ſilk-thread upon one of the Branches of this Plant, as hard as might be, and not break the skin; there follow'd no greater ſwelling, that I could diſcern, on the one ſide of the ſilk than on the other; although in often repeating the Experiment, ſome ſilks were left hours and dayes unlooſed, and yet the dimple which the thread had made in the yielding branches, had a little raiſed the immediate ſides, but both alike: the Plant in like manner would bleed very freely both above and under the Tye. This was alſo, I thought, very remarkable, amongſt other things, in this Experiment, that in drawing the Raſour round about the branch juſt above or below the Tye, the Milky Juyce would ſuddenly ſpring out of infinite ſmall holes, beſides the made orifice, for more than half an inch above and below the Tye: which ſeems to argue, that though there was no Juyce intercepted in appearance from any turgeſcence, (as in the proceſs upon the members of a Sanguineous Animal) yet the Veins were ſo over-thronged and full, that a large orifice was not ſufficient to diſcharge the ſudden *impetus* and preſſure of a ſome-ways ſtreighten'd Juyce.

I have endeavour'd many wayes to diſcover the Configuration of the Veins of Vegetables and their other conſtituent parts and Texture; but enough of this in one Letter.

4. *March* 17. 167$\frac{0}{1}$. *York*.

To the end that I might ſatisfie my ſelf about ſome of the doubts I ſent you, I have been moſt concern'd, according to former thoughts and inclinations, in examining the Truth of theſe Quæries, *viz. Whether Saps are not to be found at all ſeaſons of the Year in a much like Conſiſtence and Quantity in the reſpective parts of a Vegetable; and what Communication one part of a Plant may have with another in relation to the Aſcent and Deſcent of Sap?*

Now, becauſe Sap is then ſaid to Aſcend from the Root, when it is found to move in Tapping; I lopp'd off certain Branches of a *Sycamore*, the morning betimes of a hard Froſt (*Febr.* 21.) before they would bleed, or ſhew any ſigne of moiſture. This I did to vary the *Efficient*, not willing to wait the Change of the Weather, and the *Suns* heat; but brought them within the Air of the *Fire:* And by and by, as I expected, they bled apace, without being ſenſibly the warmer.

The Experiment repeated afforded me divers *Phænomena*, which follow; and proved *almoſt* an Univerſal way of Bleeding all ſorts of Trees, even thoſe, which of themſelves would not ſhew any ſignes of moiſture.

1. Poles of *Maple*, *Sycamore* and *Walnut*, cut down in open weather, and brought within the warmth of the Fire, did bleed in an inſtant. Alſo *Willow*, *Hazel*, *Cherry*, *Woodbind*, *Blather-nut*, *Vine*, *Elder*, *Barbery*, *Apple tree*, *Ivy*, &c. *Whicking* and *Egge berry* Tree (i.e. *Padus Theophraſti*) tried in the ſame manner in *Craven*.

2. *Briar* and *Rasberry-rods* were more obſtinate. *Aſh* utterly refuſed, even heated hot.

3. Branches, that is, Poles with their tops entire and uncut, bleed alſo when brought to the Fire ſide; but ſeem not ſo freely to drink up their Sap again when inverted, as when made Poles.

4. The ſame *Willow-Poles*, left all night in the graſs-ſpot, and return'd the next day to the Fire-ſide, bleed afreſh.

5. *Maple* and *Willow-Poles* bleed and ceaſe at pleaſure again and again, if quickly withdrawn and balanced in the hand, and often inverted to hinder the Falling and Expence of Sap: Yet being often heated, they will at length quite ceaſe, though no Sap was at any time ſenſibly loſt. And when they have given over bleeding, that is, ſhewing any moiſture, by being brought within the warmth of the Fire, the Bark will yet be found very full of Juyce.

6. An hard Ligature made within a quarter of an inch of the end of a *Wood bind* rod, did not hinder its bleeding at all when brought within the warmth of the Fire.

7. *Maple* and *Willow-Poles*, &c. quite *bared* of *Bark*, and brought to the Fire, will ſhew no moiſture at all in any part.

8. One *Barbery*, or *Pipridge-pole* bared of its Bark, brought to the Fire, did ſhew moiſture from within the more inward Circles, though not any from the outward.

9. *Maple* and *Willow-poles*, &c. *half* bar'd of Bark, woud

bleed by the Fire, from the half onely of thoſe Circles, which lay under the bark.

10. *Maple* and *Willow-poles*, ſplit in two and planed, would not ſhew any moiſture on the planed ſides, but at the ends only.

11. A Pole of *Ivy* did of it ſelf exudate and ſhew a liquid and yellowiſh roſin from the bark and near the pith; but when brought to the Fire-ſide, it bled a dilute, thin and colour-leſs Sap from the intermediat wood Circles.

12. A Pole of *Willow* (for Example) bent into a bow, will ouſe its Sap freely, as in bleeding either ſpontaneouſly or by the Fire.

Extract of a Letter, Written to the Publiſher by Francis Willoughby *Eſq;, from his Houſe at* Middleton *in* Warwickſhire *March* 16. $167\frac{0}{1}$. *relating to ſome particulars, above mention'd in M.* Lyſter*'s Communications of* Feb. 15. $167\frac{2}{1}$.

SIR, My buſineſs and want of time to proſecute Experiments, I hope will plead my excuſe for not anſwering yours of *Feb.* 18. ſooner. Since that, we have review'd our old notes, and made ſome few Experiments, and finde, that Branches of *Willow*, *Birch*, and *Sycamore*, cut off and held perpendicularly, will bleed *without tipping*; and that the cuting off of their tops does not ſenſibly promote the bleeding. We have not yet made trial in *Maple* and *Walnut*, the weather having been ſuch, that thoſe Trees have not run freely ſince the receipt of your Letter. We doubt not of Mr. *Lyſter*'s diligence and veracity, and wonder, our Experiments ſhould differ*. The Trials we have made this year, confirm thoſe we communicated to you formerly, *viz.* The *Sycamore* bleeds upon the firſt conſiderable Froſt, after the Leaf is fallen, as it did plentifully the 16th of *November* laſt: And both that, *Walnut* and *Maple* bleed all Winter long after froſts, when the weather relents, and the Sun ſhines out; but *Walnut* and *Maple* begin not ſo ſoon as the *Sycamore*. The *Birch* will not bleed till towards the Spring. This year it began ſomething ſooner than ordinary about the beginning of *February*.

* See this difference removed below, by Mr. *Liſter* himſelf.

We cut off pretty big branches of *Birch*, and, having tipp'd the ends, inverted them, and faſten'd a *Limbus* or ring of ſoft wax to the *great* ends,which we held upwards; making with the plane of the end a Veſſel of about an inch deep, where-into we powred water,which in a few minutes ſunk into the pores of the wood,and running quite through the length of the branch, dropp'd out of the ends conſiderably faſt,continuing ſo to do as long as we powr'd on water. The like Experiment we made by faſtening ſuch rings of wax to the *leſſer* ends, and powring in water, which run through the wood, and dropp'd out of the greater ends, as faſt or faſter. This we tried once upon a *Sycamore* without ſucceſs.

Extract of a Letter of the above-mentioned Mr. Liſter, *written to the Publiſher from* York, *April* 8. 1671. *both in relation to the further Diſcovery of the Motion of Juyces in Vegetables, and removing the difference noted in the next fore-going Letter.*

SIR, Yours of the 4th inſtant came ſafe to my hands. This laſt Month hath been a buſie time with me in my private concerns, ſo that I have but a few things to return to what you have been pleaſed to communicate to me,in relation to the further diſcovery of the Motion of Juyces in Vegetables. And I muſt acquaint you, that theſe Notes following are above 14 dayes old; for I have ſcarce buſied my head,or put my hand to any Experiment of later date.

One or both ends of the pith of a *Willow-pole* ſeal'd up with hard wax, will yet freely bleed by the warmth of the Fire. This was tried,when the laſt Experiments, I ſent you, were; and were then, I think, omitted.

March 23th was the greateſt Froſt and Snow we have had this Winter in theſe parts about *York.* Some Twigs and Branches of the very ſame *Willow-tree*, as formerly, and likewiſe of many other Willow-trees, taken off this morning, *March* 23th, when brought within the Air of the Fire,would ſhew no moiſture at all; no not when heated warm, and often and long turn'd.

March 24th, the ſame *Willow-branches,* which yeſterday would not bleed, and were thrown upon the Graſs-ſpot all night; did, both they and others, new cut down by the Fire-ſide, freely ſhew moiſture and bleed this morning upon the breaking up of the Froſt.

Aſh-poles and *branches* this day, nor yeſterday, would by the Fire be no more moiſt, than when I formerly tried them.

The ſame morning *March* 23th, a Twig of *Maple*, which had had the top cut off the 7th of *February* laſt paſt, and which then bled, this day being quite taken off from the Tree, and brought within the Air of the Fire, and held with the formerly cut-end downwards, did not run at all at the end, but held on in that poſture, it did run apace at the other new-cut end uppermoſt, ſo as to ſpring and trickle down.

Note, That this doth well agree with my Experiments made the laſt year at *Nottingham*, where I obſerv'd wounds of ſome months ſtanding to bleed apace at the breaking up of every hard Froſt. For *firſt*, in theſe parts there hath been no hard Froſt this year, not comparable to the laſt year. *Again*, thoſe *Nottingham*-trees I wounded in the Trunk, and they ſtood againſt a Brickwall, and the wounds were on the ſide next it; and beſides had Horſe-dung ſtopp'd in all of them for ſome reaſons; which things did undoubtedly defend them much from the Air and Winds, and keep the wounds ſtill green and open: Wheras the tops of theſe *Maple-twiggs*, ſpoken of in the laſt Experiment, were expos'd in an open hedge to the Air and Winds; as alſo the two *Sycamores* here at *York* mention'd in my *former* Letter to have been wounded in *November* laſt, and not to have ſhew'd any ſignes of moiſture, for that very cauſe, that they were not freſh ſtruck at Bleeding times.

Concerning the Bleeding of *Poles* and entire Branches held perpendicular, Mr. *Willoughby* is in the right, and ſome Experiments in my laſt to you of *March* 17th confirm it. Yet it is very true what I obſerv'd, though the Cauſe I did not then well take notice of, when I firſt made the Experiment and ſent you an accompt of it. For, I held the Twigs, which I had cut off, a-ſlope, joyning and holding up the cuts together in my left hand, that I might the better obſerve, which part or cut would bleed or not bleed the faſter; and becauſe I found, that the cut of the ſeparated Twig did not in that poſture (holding it upwards, as I ſaid, for the advantage of my eye) bleed at all, when as the Cut of the Branch remaining to the Tree did freely bleed;

I therefore inverted the ſeparated Twig and held it perpendicular with the cut end downward, and found, that that little they were expos'd to the Air in an upright poſture, had ſo very much check'd the motion of the Sap, that I concluded they would not bleed at all; and yet ſtriking off their tops, and making Poles of them, I found ſome of them, if not all, that I chanc'd to try, as I remember, would ſhew moiſture: But I am convinced ſince, that it was rather ſome unheeded accident, as violently bending them, or perhaps the warmth of my hand and ſeaſon, or place, which cauſed this new motion of Sap, than meerly the ſtriking off their Tops.

Some Communications, about an early Swarm of Bees, *as alſo concerning Cyder; Deſcent of Sap; the Seaſon of Tranſplanting Vegetables: Sent to the Publiſher out of* Herefordſhire *by that Intelligent Gentleman,* Richard Reed *Eſq*;, *in a Letter dated March* 14. 167$\frac{7}{8}$. *at* Lugwardine.

ON Thurſday laſt, the 9th of Inſtant, there was at the next houſe to mine a *Swarm* of *Bees*. It was a very fair day to entice them; but elſe *we* never have them till the middle of *May*. I had it from the owner, one *Parry*, now in my work, and I enquir'd of him, whether they did not all leave the Hive, as ſometimes they do unſeaſonably, either for want of food, or out of diſtaſte? He told me, no, but there are as many left behind as came forth. But I (who have ſometime ſtudied the Regiment of that little induſtrious wiſe creature) do conceive, that Poverty drew them abroad to ſeek their fortunes; the infinite Wiſdom having imparted ſuch a Providence to that little Commonwealth, as to ſend part of their Company abroad to ſhift, before their whole ſtock of food ſhall be conſumed, to the deſtruction of them all, (*Deus Maximus in Minimis.*)

And now to what I formerly promiſed. I have read that excellent Book of Mr. *Evelyns*; eſpecially his *Pomona*, and have learnt many things out of it, which I before had not obſerv'd; and particularly the new way of Planting therein mention'd out of the papers of my Ancient and worthy Friend Mr. *John Buckland*, whom I do never remember but with very great reſpects: As alſo the New way of making *Pepin-Cyder* by Sir *Paul Neil*, to whom (unknown) I do, and our whole Country ought to return very many thanks. For certainly, the reaſons, rendred by him of the harſhneſs and the cure of it in

Pepin-cider, are very ſound, and may be uſed to the advancement of *all* our Ciders. I had the laſt year two parcels of Pepin-Cider; of the *one* but few bottles, and that was the Droppings of the *Cheeſe* (ſo we call the Apples when ground and preſt) after we had wrung it as far as we could, and that comes away without any mixture at all of the Pulp of the Apple, being that *Flying Lee* mention'd by Sir *Paul.* The *other*, a Veſſel containing two *Hogsheads*; and *that* (following the reaſon of the directions he giveth, but not having Veſſels to draw it off that Flying Lee when ſetled, and to purſue thoſe directions exactly,) I ſtrained thorow a courſe cloth into the Veſſel, and by that means eas'd it of much of that Lee. Both were excellent good, both for Colour and Taſte; but the Bottles beſt, being the moſt delicious and luxuriant Cider, and moſt pleaſing both for colour and taſt, that ever I knew; yet I have had as good *Red-ſtrake* as ever I drank in any place.

I do commend, for the advancing of Cider in richneſs both for Taſt and Colour, a New Cask; provided it be made of Timber very well ſeaſon'd: otherwiſe it may ſpoil it utterly. The Veſſel I mention'd, wherein I had my Pepin-Cider, was ſuch. And I have often tried it, and found that ſort of Cask to improve Cider.

The beſt Cider, I ever had, was *Red-ſtrake* grafted upon a *Gennet-moyle-ſtock.* For, as thoſe kinds do beſt agree, and the Trees ſo grafted ſeldom Canker (as do the old Red-ſtrake upon a Crab-ſtock)ſo the Fruit is far more ingenuous and milder, and being ripe, both rich and large and good to eat, and the Cider is more ſmooth, and abates in ſtrength and harſhneſs of that on the Crab, and needs leſs of mellowing before making; the ſtock in degree altering and reclaiming the nature of the Fruit. For, as an Apple doth beſt grafted on a Crab, which gives acrimony and quickneſs to the Fruit; ſo a Crab (and the Red-ſtrake is no other) grafted on an Apple, receiveth thence gentleneſs, and ſoftneſs, and largeneſs, and an excellent alloy to the ſharpneſs, and (as Mr. *Evelin* calls it) the *wickedneſs* of the Fruit. Which(being but a diſcourſe of the Intercourſe between the Saps both of Stock and Graft) puts me in mind to beg from you the judgement of thoſe Gentlemen of the *R. Society*, that bend their thoughts to this way of knowledge concerning the *deſcent* of the Sap in Winter, which is now generally denied: Though I, as yet, cannot aſſent to it; thinking it an Hereſie in Husbandry, obſtinately to deny the deſcent of the Sap. Beſides many other Experiments to prove that decent, this I have obſerved, which I never heard any other did: That the Graft hath influence either to corrupt or to heal the Stock; nay further, to alter and change the very nature and way of the growing of the Root in the earth; which I cannot ſee how it ſhould do but by ſending down its Sap thither. I have by certain Obſervation found, that Crab-ſtocks grafted with ſome ſorts of Fruit, which the Soil liketh not, they not the Soil, will (not one or two, but all of that ſort) Canker, not only in the Graft, but the Stock alſo: which if you graft again, upon the former Graft, with a fruit liking to the Soil, will all heal, and ſo become Trees. And further, certain it is by my Obſervation, that 20 Pear-ſtocks being wild, grafted young with the ſame ſort of Pear, and 20 with another; the Roots of each of them of one ſort will grow alike; and ſo thoſe of the other. Generally thoſe that naturally grow high, as the *Bare-land*-Pear, root deep, and all do ſo: Thoſe whoſe Heads are buſhy and thick, as the Summer *Bon Chreſtien*, their Roots run wide, and are matted below; and all are ſo. This diverſity of the way of growing of the Root muſt be by grafting, and could not be but by the intercourſe of Sap, which it receiveth from the Graft; and that cannot be, but by the return of the Sap.

But in this I deſire rather the judgement of others, than give mine own, becauſe it is of a conſtant uſe to me, to be well aſſured herein. For if the Sap returns not, then may I prune or lop my Trees in any time of the year without loſs of Sap, which I take to be their Blood, and that wherein their life conſiſts.

Concerning the *Seaſon* of *Tranſplanting*, which ſome direct to be in *October*: I did think, and uſed to do ſo alſo; but for theſe later years, I never begin to plant till *Valentine*'s day, though I have a mild and good Winter, as this was. And I approve late Planting before early; and as yet, however the Spring or Summer often do prove, looſe fewer by miſcarriage. The *Cold* in the Winter kills more than the *Drought* in Summer; however it proveth (as the laſt of 1669 was the worſt I have known;) only the Cold does the work, and we impute it to the drought; becauſe they languiſh until Summer upon the fatal blow they receive by the Cold in Winter; and then dye. For, either we take our Stocks out of Woods, or out of Nurſeries; in either place they lye warm. If you then in *October* tranſplant them, you expoſe them on a ſudden to an open Air, and adventure them; being weak, to a long and perhaps cold winter; which they cannot bear, no more than our Men un-uſed to a Voyage beyond the Line, can the heat. Add hereunto, that I can relieve them againſt the Drought, by watering and covering the ground, to keep it cool: But there is no fence againſt the Froſt; which many times gets into the Roots, and kills, ſo that they never ſpring; or, if they do, yet pulingly, and dye in the Spring; or, if they ſurvive, as many do, yet come on very ſlowly and pitifully. For, the Bark does cleave to the wood by reaſon of the cold, which dries and clings them together, that like an hide-bound horſe, they will not admit the Sap, which the Root would ſend up; and other Suckers grow out at the earth, and the Tree grows dry, and turns red: All which diſcovers the Obſtruction in the receiving the Sap, which would come from the root; and then we are forc'd to ſcore and looſen the Bark as we can. Now on the other ſide, if the Summer prove moiſt, the danger and fear of late ſetting is over, and they will thrive and come forward amain; if otherwiſe, I ſeldom ſee but they alwayes keep green and freſh, being maintain'd in life and verdure by the Sap they receive in the beginning of the *Spring*, before they be tranſplanted.

This therefore I do (which I ſubmit to better judgments and experience;) In the dead of Winter I prune and cut the Tree I intend to tranſplant, as I would have it be, to the end to loſe nothing of its ſtrength when I tranſplant. Then I ſuffer it to abide untouch'd by the Spade till *Valentine*'s day, and then remove it after it hath taken in ſomewhat of the Spring. This, I think, will cauſe it to take better and grow better. Niceties in Grafting or Planting I will not trouble you with, nor care I for; but this I thought good to offer to the experience of others (having found it far beſt in mine) becauſe it is that which is of daily and general uſe; and if this ſeaſon be found beſt, it will be that which will be of great advantage to this kind of Husbandry.

In Tranſplanting I am very careful to preſerve and ſet the Roots as large as I may; ſuppoſing the larger the Root, the more of ſtrength and Sap it contains, and ſo will advance the more the growth of the Tree; ſince every thing grows in proportion to the Root beneath: But I am doubtful in this, whether I do well or ill, and deſire the judgement of others. For, I have heard from ſome Planters, and afterwards from a Knight who had experience therein, that Roots cut ſhort doe beſt, as ſending forth New roots, which draw ſap and nouriſhment beſt. And we ſee that *Moyles* ſet on ſlips that have no roots, come to a Tree ſooner. And I have oft obſerved, that a *Moyle* Tranſplanted after it hath taken root does not live ſo certainly, or thrive ſo well as a ſlip newly ſet. But I have gone beyond the bounds of a Letter.

This Letter being imparted to an Ingenious Inquirer into ſuch things, he was pleaſed to return ſome of his conſiderations thereupon, which are like to be publiſhed in our next.

Some Obſervations, touching Colours, *in order to the Increaſe of* Dyes, *and the* Fixation *of Colours; generouſly imparted by the Author of the Four above-mention'd Letters, who annexed them to that of* Februar. 15. 1670.

TWo things, I conceive, are chiefly aimed at in the Inquiry of *Colours*, which ſubject you deſire my thoughts of; the *one*, to increaſe the *Materia Tinctoria*, and the *other*, to *fix*, if poſſible, thoſe colors, we either have already, or ſhall hereafter diſcover for uſe. As to the *firſt*, Animals and Vegetables, beſides other Natural Bodies, may abundantly furniſh us. And in both theſe kinds *ſome* Colours are *Apparent*, as the various colours of Flowers, and the juices of fruits, &c. and the *ſanies* of Animals: *others* are Latent, and diſcovered to us by the effects, the ſeveral Family's of Salt and other things may have upon them. Concerning the *Apparent* colors of Vegetables and Animals, and the various effects of different Salts in changing them from one colour to another; we have many Inſtances in M. *Boyle*. And if we might, with the good leave of that Honourable and Learned perſon, range them after our faſhion, we ſhould give you at leaſt a new Proſpect of them, and obſerve to you the conformity and agreement of the effects of Salt on the divers parts of Vegetables: *Viz.* 1. That *Acid* Salts *advance* the colours of Flowers and Berries, that is, according to the Experiments of M. *Boyle*, they make the infuſions of *Balauſtium* or Pomgranat-Flowers, Red roſes, Clove-jilly flowers, Meſerion, Peaſe-bloom, Violets, Cyanus flowers, of a fairer red; alſo the juices of the Berries of *Liguſtrum*, of black Cherry's, Buck-thorn-berries, of a much fairer red: and to the ſame purpoſe Acid Salts make no great alterations upon the white flowers of Jaſmin and Snow-drops. 2. That *Vrinous* Salts,and *Alcaly's*, on the contrary, quite alter and change the Colours of the ſame flowers now named, and the juices of the ſaid Berries alſo,from red to green; even Jaſmin and Snow-drops. 3. Again,that in like manner *Vrinous* Spirits and *Alcaly's* advance,at leaſt do not quite ſpoyle the colors of the juices of leaves of Vegetables,of their Wood and Root. Thus M. *Boyle* tells us,that *Vrinous* Spirits and *Alcaly's* make the yellow infuſions of *Madder-roots* red; of *Brazil-wood*,purpliſh; of *Lignum Nephriticum*, blew; the red infuſion of *Log-wood*,purple; of the Leaves of *Sena*,red. 4. That, on the contrary,*Acid* Salts quite alter and change the ſaid infuſions from red or blew,to yellow.

In the next place we would note to you the effects of Salts upon *Animals* in the production and Change of colours;but the Inſtances are very few or none, that I meet with in any Author; the *Purple-fiſh* being quite out of uſe, and *Cochineil* and *Kermes* are by moſt queſtioned,whether they are Animals or no; but I think,we may confidently believe them both to be *Inſects*,that is, Worms or *Chryſulys*'s of reſpective Fly's *in proxima fœtura*. We find then,and have tried concerning *Cochineil* (which of it ſelf is red,) that upon the affuſion of the Oyl of Vitriol,that is, an *Acid* Salt,it ſtriks the moſt vivid *crimſon* that can be imagined; and with *Vrinous* Salts and *Alcaly's*, it will be again changed into an obſcure color 'twixt a violet and a purple. *Pliny* ſomewhere tells us, that the *Gaules* in his time could dye with Vegetables,what the Romans with ſo much danger and pains ſought for in the bottom of the Sea. Indeed, we find many Plants mentioned by the ſame Author, which either are not known to us at this preſent,or neglected.

To what we have briefly obſerved out of Authors, we will ſubjoyne ſome of our own Conſiderations and Tryals And *firſt*, concerning the *Apparent* Colours in Flowers, we think we may inſert; 1. That generally all Red, Blew and White flowers are immediately, upon the affuſion of an *Alcaly*, changed into a Green colour,and then,in proceſs of no long time,turned Yellow. 2. That all the parts of Vegetables, which are green, will in like manner ſtrike a Yellow with an *Alcaly*. 3.That what Flowers are already yellow, are not much changed,if at all,by an *Alcaly* or *Urinous* Spirit. 4. The Blew ſeed-husks of *Glaſtum Sylveſtre* old,gathered and dry,diluted with water,ſtain a Blew, which upon the affuſion of Lye ſtriks a Green, which Green or Blew being touched with the Oyl of Vitriol dyes a Purple; all theſe three colours ſtand. 5.On the tops of *Fungus tubuloſus*,ſo called by M. *Wray* in his late Catalogue of the Plants of *England*,are certain red knots; theſe,upon the affuſion of Lye, will ſtrike a Purple,and ſtand.

As for the *Latent* Colours in Vegetables and Animals; to be diſcovered to us by the affuſion of Salts; they likewiſe, no doubt, are very many. We will ſet down only a few inſtances in both kinds, which have not been,that we know of, diſcovered or taken notice of by others. *Latent Vegetable* colours, 1.The Milky juice of *Lactuca Sylveſtris coſtâ ſpinoſa*, and *Sonchus aſper & lævis*, upon the affuſion of Lye, will ſtrike a vivid flame-colour or Crimſon,and after ſome time quite degenerate into a dirty yellow. 2.The Milk of *Cataputia minor*, upon the affuſion of Lye, eſpecially if it be drawn with a knife, and hath any time ſtood upon the blade of it,will ſtrike a Purple or Bloud-red colour,and by and by change into an ignoble yellow. *Latent Animal* dyes, 1. The common Hawthorn-Caterpillar will ſtrike a Purple or Carnation with Lye, and ſtand. 2.The heads of Beetles and Piſmires, &c. will with Lye ſtrike the ſame Carnation-colour,and ſtand. 3. The Amber-coloured *Scolopendra* will give with lye a moſt beautiful and pleaſant *Azure* or *Amethyſtine*, and ſtand.

Laſtly,we might conſider the *Fixing* of colours for Uſe; but we are willing to leave this to more experienced perſons,as alſo the Philoſophizing on the particulars we have produced,to better Heads. Some obvious Inferences we may venture to take notice of; 1. That in all the Inſtances above mentioned,whether Vegetable or Animal, there is not one colour *truly* fixed,however there may,I conceive, be ſome uſe made of them,as they are. I ſay,*truly fixed*, that is, proof of Salt and Fire; for,what ſeem to *ſtand* and be *Lye-proof*, are either wholly deſtroyed by a different Salt, or changed into a much different colour; which muſt needs prove a ſtain and blemiſh,when it ſhall happen in the uſe of any of them. 2. That both the apparent and latent colours of Vegetables are *fixable*: An inſtance whereof we may obſerve in the ſeed-husks of *Glaſtum*, and the Uſe Diers make of the leaves after due preparation. 3. It is probable from the ſame inſtance, that we may learn from the colour of ſome part of the Fruit or Seed, what colour the Leaves of any Vegetable and the whole Plant might be made to yield for our uſe. 4. That the *Latent* colours of Vegetables are præexiſtent, and not produced; from the ſame inſtance of *Woad*, and likewiſe from this that the *Milky* juyce of *Lactuca Silveſtris* doth afford it ſelf a *Red* Serum. 5. That the change of colours in Flowers is gradual and conſtant. 6. That the colours of Flowers, which will not ſtand with Lye, ſeem to be wholly deſtroyed by it, and irrecoverable: Thus it happens in the Experiment; that one part of a Violet-leaf, upon the affuſion of Lye, is changed very ſoon into yellow, and will never be revived into a red by an Acid ſalt; but if another part of the ſame leaf be ſtill green, it will be revived, 7. That the Dryneſs ſeems to be a means, if not of *fixing*, yet bringing the Vegetable colour into a condition of not wholly and ſuddainly periſhing by the otherwiſe deſtroying *Alcaly*. 8. That thoſe Plants or Animals that will ſtrike different and yet vivid colours upon the affuſion of different Salts, and ſtand, as the *Cochinel* and *Glaſtum*, are probably of all others to be reckoned as the beſt Materials.

It would have been a much ſafer way, to have put theſe Inferences in the faſhion of *Quæri's*; but beſides that I affirm no more but matter of fact, it is lawful for our encouragement (as my Lord *Bacon* adviſes) to ſet up reſts by the way, and refreſh our ſelves with looking back, though perhaps we have not much advanced. You will be pleaſed to excuſe the little cohærence that I have uſed in theſe notes, and attribute it to the readineſs and affection I have to anſwer ſuch inquiries as you put to me. I never yet did make this ſubject any part of my buſineſs, but the deſire I have to ſearch after and examine the Medicinal qualities of things in Nature, hath by the by preſented me with ſuch *Phænomena*, as I was not willing to leave unnoted, nor to refuſe them you, though in a confuſed way, becauſe you deſire them. To conclude, how immethodical and barren theſe papers may ſeem; yet the conſideration of them hath led me to a way of *Fixing* colours, which I willingly forbear to relate, until I may have an opportunity of ſhewing the Experiment before the *R. Society*. I have found out a Colour moſt exquiſitely black,& comparable to the beſt ink;even in the uſe of the pen, and which will not change by Fire or Salt. This an *Engliſh* Vegetable yielded me, and for ought I know (for I have not repeated the trial on any thing elſe) the like method will ſucceed to good purpoſe. I am, *&c.*

An Accompt of ſome Books.

I. *Theodori Kerckringii M. D*, *ANTHROPOGENIÆ ICHNOGRAPHIA*; *ſive Conformatio Fœtus ab Ovo uſque ad Oſſificationis principia, in ſupplementum Oſteogeniæ Fœtuum.* Amſtelodami, 1671. *in* 4°.

After that this Author had the laſt year publiſhed, together with a *Specilegium Anatomicum*, his *Oſteogenia Fœtuum* (both which were deſcribed *N°*.54.*p.* 1094. *ſeqq.*of theſe Tracts;) in in the latter of which he had given an Accompt of the Formation of the *Bones* of an Humane Body, from the *Second* Month after Conception to the very time of the Infants Birth; he conſidered, that there were two things yet left behind, neceſſary to the perfect knowledge of *Oſſification*;*viz. Firſt*, what might be the Rudiments and Form of an Human Body, before it came to have any Firmneſs of Bones. *Secondly*, How after an Infants being born, the ſoft Bones acquire by little and little both their Hardneſs and Magnitude. Waving for the preſent the latter of theſe two, he undertaketh in theſe ſheets (which are but *three*) to deliver the firſt Elements, as'twere of our Body, *from* and even *before* the time of Conception; affirming.

1. *Non tantùm in nuptis & fæcundis Mulieribus, ſed etiam in Virginibus eſſe non minùs quàm in Gallinis ova ponentibus etiam citra Galli conſuetudinem, ova quædam * piſi viridis magnitudine, in quibus humor latet intus, qui, uti aliorum ovorum albumen & vitellus, dum coquitur, indureſcit : Porro, ova illa mulierum, pelliculis extrinſecus circumdari, quæ poſtquam in uterum prolapſa ſunt ova coitu fœcundata, in Amnion & Chorion brevi commutentur; ova autem ipſa, duorum vel trium dierum ſpatio ad ceraſi nigri majoris magnitudinem excreſcere.*

* *Vide* Nic. Stenonis Muſculi Deſcriptionem Anatomicam *editam* A. 1667. *& deſcriptam* N°.32. *Ubi in Narrationum ibi annexarum poſteriori dictus Dn.* Steno *memorat, per digreſſionem,* dari in Fœminis Teſtes ovario analogos. *Ipſe Author noſter obſervat etiam*, Fallopium *jam tale quid notaſſe.*

2. Tha

2. That he once met with and open'd a *fœtus* of but *three*, or, at moſt, *four* dayes old, (How he came to know and do this, almoſt incredible thing, the Book it ſelf relateth;) and found in a little Globul, that Nature had already form'd therein the Rudiments of an humane Body, ſo as that he could plainly diſtinguiſh the Head from the maſs of the Body, and ſee in the Head (though but obſcurely) ſeveral pricked marks for Organs; the Body in the mean time being nothing but an undigeſted lump.

3. That in a *Fœtus*, *fifteen* dayes old, he could diſtinguiſh the Eyes, Noſe, Mouth and Ears, Arms and Feet.

4. That in another, *twenty and one* dayes old, he was able to ſeparate the matter prepared for Fleſh and Skin, from that which was to be hardened into Bones. As alſo, that the Head ſeemed nothing but a membrane diſtended with wind and ſpirits; but its Arms and Hands were figured, and the Fingers and Toes themſelves diſtinct. Beſides, that in that Cartilagineous part, deſigned for the Bones, he could number the Ribs.

4. That in one of the age of a *Month*, he diſcover'd ſome more conſiſtency, and the upper and lower Jaw-bone repreſented by two Bony pricks; beſides the *Claviculæ* form'd, and almoſt all the Ribbs diſtinct, the Shoulder-blade, and Elbowes, Thigh-bones, and both the Leg-bones, call'd *Focilia*; (where, by the by, he intimateth, that a certain Acid ſpirit in the world is the Efficient, as of all Firmneſs & Solidity, ſo of that in Bones.)

5. That *laſtly* in a *Fœtus* of ſix Weeks he found, that it only differ'd in Bigneſs from that of *Two Months*, by him formerly deſcribed in his *Oſteogenia*; but that the main thing, he took notice of in this, was the diſtinction of ſix ſmall Bones in the lower Jaw, which after the production of the *Fœtus* into the world do coaleſce into one.

All this the Author hath repreſented by *Schemes*, and endeavoured to confirm by anſwering what may be objected againſt his Obſervations. Mean time 'tis hoped, that what hath been performed a good while ſince, upon this very curious and nice ſubject in *England* by the Learn'd Dr. *Timothy Clark*, one of his Majeſties chief Phyſitians, will at laſt be made publick to the ampler ſatisfaction of inquiſitive Anatomiſts, and the more intimate knowledge of that moſt admirable contrivance and ſtructure of Man.

II. *PHILOSOPHIA VETERUM, é mente Renati Deſ Cartes breviter*

breviter digeſta, *ab* Antonio le Grand. *Londini*, *apud* J. Martin, *R. Soc. Typographum* , *ad Inſigne Campanæ in Cæmiterio S. Pauli. An.* 1670. *in* 12°.

This Epitome of the *Carteſian* Philoſophy, digeſted by the Author for the uſe and advantage of thoſe, that have inclinations to initiate themſelves in the doctrine of that Famous Philoſopher, begins this his Book by delivering the main Rules, by him eſteem'd neceſſary to the acquiſition of Truth. Thence he proceeds to thoſe ſimple Notions, of which our Cogitations are compounded, and concludes this part with a ſhort doctrine of the *Syllogiſm.*

Having ſuccinctly diſpatcht this, he paſſeth on to treat of *Phyſiology*, and exploding the *Materia prima* , the *Subſtantial Forms*, the *Real Accidents* (as theſe are vulgarly taught) he maketh it his buſineſs to prove, That there are Bodies extended in Length, Breadth and Depth, to which belong *Figure*, *Motion*, *Scite*, &c. no otherwiſe than as ſome diſtinct *Modes*. After this, he conſiders the *Heavens*, *Earth*, *Water*, *Air* and *Fire*, and of what parts they are conſtituted. Next, he explains the Fabrick of Man ; and giveth an account, how he comes to move and have perception. And he cloſeth all with a Demonſtration (as he ſuppoſeth it to be) of the Exiſtence of a God.

But we ſhall ſay no more of this, ſince we find our ſelves obliged to diſcourſe ſomewhat more largely of an ample Treatiſe of this ſame Argument , lately come to our hands from *Paris* ; *viz.*

III. *TRAITE DE PHYSIQUE par* Jaques Rohault. *A* Paris, 1671. *in* 4°.

After that the Author hath in this Ingenious Treatiſe aſſigned the Cauſes, why *Natural Philoſophy* hath been ſteril for ſo many Ages, and found them to be theſe, *viz.* the too ſervil addiction to Authority ; the reſting in Metaphyſical, abſtract and general ſpeculations ; the ſevering of Reaſon and Experience ; and the Neglect of the Mathematiques ; He divideth it into *Four* principal parts.

In the *Firſt*, he treateth of the *Body Natural*, and its chief Proprieties, Diviſibility, Motion and Reſt ; as alſo, of the Elements and the ſenſible Qualities ; where he inſiſteth at large upon the Explication of the Nature and Qualities of Viſion, not ſcrupling to affirm, that upon this ſubject alone he hath collected and deliver'd more Truths in eight or nine Chapters, than are contained in many great Volums, which treat of Opticks, Dioptricks and Catoptricks after the manner of the Antients. In this part 'tis chiefly that *Ariſtotle*, but eſpecially his quarrelling and claſhing Commentators and Followers, are taken to task; the Author repreſenting the *Peripatetick* Principles as altogether inſignificant and uſeleſs, for a rational Explication of any effect in Nature, and taking notice, that *Privation* (one of thoſe principles) is not *in* things nor concurs to their compoſition; that *Matter* (another principle) is, according to them, a ſomething I know not what, and *Form* (the third) ſuch another I know not what; as if giving a meer Name to a thing not known, were enough to make it known. Beſides which, he obſerveth, that the ſame Sect hath introduced in Philoſophy ſtore of ſpecious notions, altogether Chymerical, as Nature's *Abhorrency of a Vacuum*, *Attraction*, *Sympathy* and *Antipathy*, &c. invented to give a reaſon in ſhew of what was not at all underſtood. For, *ſaith he*, what doth it teach a man of the Nature of a *Loadſtone*, to ſay, it hath an *Attractive* vertue, or a Sympathy with Iron. And the *Fear of a Vacuity* anſwers a Queſtion no more, than if a man, being asked, How the Wood came to *Paris* out of remote Provinces, ſhould anſwer, It came there by the *Fear of Cold*, that is, anſwer from the *Final* cauſe, when the *Efficient* is demanded. Moreover, he rejecteth the *Ariſtotelian* Elements, as well as the common *Chymical* ones, and endeavours to eſtabliſh the three *Carteſian*; proceeding from the *Firſt Diviſion* and *Motion*, ſuppoſed to have befaln the Uniform Matter produced by the firſt Author of things. He noteth further, that the *Peripaticks* explain not to any purpoſe, wherein the Senſible Qualities do conſiſt, teaching nothing ſatisfactory of Siccity, Humidity, Hardneſs, Fluidity, Heat, Cold, Taſte, Odour, Sound, Light, Colour, &c; that they make Veſſels burſt *ex metu Vacui*; and aſſign the cauſe of the roundneſs of Drops to be the Mutual Love, which the parts of the ſame Liquor have for one another, whence a cloſe union, and ſo a roundneſs; that they affirm of Heat and Cold only what they *do* (and that erroneouſly too) and not what they *are*; that they teach nothing of what maketh a Body ſavoury, ſonorous, lucid, colour'd; that they make a great but vain ſhew with their unconceivable *intentional ſpecies*; that they aſſert Viſion to be made in the *Chryſtallin*, &c.

In the *Second* part he treateth of the *Syſtem of the World*, according to the Three celebrated Hypotheſes, of *Ptolomy*, *Copernic*, and *Tycho*, but giveth the preference to the *Copernican*, as the plaineſt and the moſt rational; eſteeming mean while, that, as to the ſcituation of the parts of the Univerſe, *Tycho* agreeth with *Copernic*, except that he maketh the Firmament to have the Earth for its Center; ſo that all the difference between theſe two Opinions as to the Earth, related

ted to the Fluid matter of the World through which it paſſeth, conſiſts only in this, that *Copernic* ſpeaketh of the motion of the Earth, as one would do, that being to tell how he had been in a Coach from *Paris* to *Orleans*, would mark a certain way, and ſay, he had paſſed over it by the motion of a Coach drawn by horſes; wheras *Tycho* would ſpeak as another man, who though he had likewiſe been in a Coach from *Paris* to *Orleans* the ſame way, yet would not acknowledge any motion neither in the Coach nor in the Horſes, but maintain, that the *Way* it ſelf had moved, and the wheels of the Coach had only turn'd about their Axle-trees, and the Horſes done nothing but lifted up their legs, to let the way ſlide away under them. He obſerveth further that the *Copernican* ſyſteme rightly underſtood attributeth no motion at all to the Earth: For, Motion being taken for nothing elſe than for a ſucceſſive application of a Body to the ſeveral parts of the immediately encompaſſing and neighbouring Bodies, 'tis plain, that what is call'd the *Diurnal* motion of the Earth, belongs rather to the Maſs compos'd of the Earth, the Seas, and the Air, than to the Earth in particular, which is to be eſteem'd in a perfect Reſt, foraſmuch as ſhe is carried away by the Torrent of the matter wherein ſhe ſwims; juſt as we ſay, that a Man is at reſt that ſleeps in a ſhip, whil'ſt the ſhip is indeed in motion: And ſo that which is called the *Annual* motion of the Earth, doth not all appertain to her, nor even to the compos'd maſs of Earth, Water and Air, but to the Celeſtial matter, which carrieth this Maſs about the Sun. After this he diſcourſeth of the Nature of the Stars and their influences. Next, he renders an Accompt of *Gravity* and *Levity* (which for want of premiſes, he could not ſpeak of in the firſt part) and maketh Gravity nothing elſe but a leſs Levity. And laſtly, he concludeth this part with the doctrine of the *Flux* and *Reflux of the Sea*, as depending from the Preſſure of the Moon.

In the *Third* part he explains the nature of the *Earth*, and Earthly Bodies, that is, ſuch as are either contain'd in it or are about it, as the Air, Water, Fire, Salts, Oils, Mettals, Minerals, and Meteors. Where, among many other Remarques, he declareth, that though the Tranſmutation of baſer mettals into Silver or Gold be not *abſolutely* impoſſible, yet *morally* 'tis; foraſmuch as men not knowing in particular, which is the Figure and Size of the little particles that enter into the Compoſition of Mettals, nor the ſhape and ſize of the other ingredients, that may be neceſſary to effect this Tranſmutation, nor have yet found the ſecret to unite them together; that therefore it may very well be concluded, that if it be true what is ſaid of ſome Chymiſts having formerly converted Lead into Gold, it hath happen'd by ſo great a chance, as if a handful of ſand being let fall from on high upon a Table, the grains had ſo orderly ranged themſelves, as to make one read diſtinctly a page of *Virgil*'s *Æneids*.

In the *Fourth* he hath endeavour'd to compriſe all what he thinks is hitherto with any certainty known of the *Body Animate*: where, amongſt a great number of other *Phœnomena*, he giveth a particular explication of *Fevers*, eſteeming, that all the ſtrange Symptoms thereof may be very well explain'd by only ſuppoſing, that a little portion of our Blood, or of ſome humor mixing with it when it paſſeth to the Heart, comes to be ſtop'd by ſome cauſe or other, in ſome place of our Body, whence it begins not to flow but at the end of a certain time, and when it is ſo corrupted that it ſomewhat reſembleth *Green Wood* in its manner of kindling, that is to ſay; this Wood being caſt into the Fire, ſeems at firſt to have no diſpoſition at all to take fire, but appears rather capable to extinguiſh it; ſo alſo this portion of corrupted humour is at firſt indiſpoſed to be heated and dilated, when it comes to paſs through the Heart; but then as the Green Wood burns at length more fiercely than what is Dry; ſo this humour may at laſt be heated and rarified much more than the Bloud is in its ordinary temper, *&c.*

IV. *Novæ Hypotheſeos de PULMONUM MOTU & RESPIRATIONIS USU Specimen.* Londini 1671. *in* 8°.

The *Anonymous* Author of this ſmall Tract being of opinion, that none of thoſe, that have hitherto written of the *Motion* of the *Lungs* and the *Uſe* of *Reſpiration*, have lighted upon the truth; undertaketh to ſhew, that the Lungs do not, as hath been hitherto received, follow the Motion of the *Thorax* and *Diaphragme*, nor are moved and filled, like Bellows, becauſe they are diſtended; alledging that he hath obſerved from the ſhape and Scituation of the *Diaphragme*, and from its Connexion with the other *viſera*, and the Breaſt and *Abdomen*, that the ſaid *Diaphragme* cannot be moved up and down, or the Cheſt, by the *Syſtole* thereof, be dilated and Inſpiration performed; foraſmuch as it is both above and below, by the intervention of divers membrans, ſo connected with other parts, that it can neither riſe nor ſubſide, no not ſo much as be impelled up and down: But that this *Riff* can only be moved forwards *extrorſum* and backwards *introrſum*; forwards in Inſpiration, backwards in Exſpiration. And eſteeming this to be its proper motion, moſt ſuitable to its Fabrick, Scite, and the whole work of Reſpiration; he declareth openly, that the Motion and Inflation of the Lungs depends not upon the Motion of the Thorax and Diaphragme, but that, for *Inſpiration*, the Lungs are dilated by the Elaſtick force of the Air ruſhing in; and that upon their Dilatation follows the Intumeſcence of the *Diaphragme* as of a Sail, and its protruſion forwards, and thereupon further the propulſion of the *Thorax*: And that for *Expiration*, the Diaphragme is again contracted, and reſtored to its juſt figure and conſiſtence, and the now effete, clogg'd and ſpring-leſs Air driven out: This Author conceiving, that as long as the force of the *inſpired* Air exceeds the Elaſtic power or the reſiſtence of the Air or the halituous ſubſtance *included* in the Cheſt, ſo long laſts *Inſpiration*; but when the force of the *included* Air, by means of the Contraction of the Diaphragme and its preſſure, overcomes the ſtrength of the *inſpired* Air, then begins and ſo long laſts *Expiration.* So that, according to him, *Reſpiration* is nothing elſe, than a Reciprocation of the Air incloſed in the Cheſt, and an Alternate motion of the Lungs and the Diaphragme; whereby the external Air becomes the firſt origin of all the Animal motion.

As to the *Uſes* of Reſpiration, he eſteems, both from a certain Relation to be found in *Fontana*, and from the ſtructure, Motion and Scite of the Diaphragme, that there are other Uſes of it, than the Cooling of the Heart, the Fanning of the Blood, the Diſcharge of ſteams, the Conveyance of a Nitrous aliment, the Comminution and ſubduing of the Blood, and its intimate commixture with the Chyle, and the promotion of the Blood from one ventricle of the heart to the other; for all this, he ſaith, is perform'd by the help of the *Lungs*, (which is but *one* Organ of Reſpiration:) But then he would maintain, that by the other Inſtrument of Reſpiration, the *Diaphragme* and its Preſſion, there are effected ſuch other things, as are no leſs neceſſary to the preſervation of life, than the former; *viz.* The continual Preſſure of the Chyle out of the ſtomach into the inteſtins, and from thence by the Milky veins into the Glanduls of the Meſentery, and ſo further into the Chyliferous Channel; as alſo the Motion of the Blood out of the *Porta* into the Liver, and out of the Liver into the *Cava*; and that of the Gall into the Bladder of Gall, and thence into the common *ductus* and the Guts: perhaps alſo that thence proceeds the firſt Natural Inſtinct or Perception, exciting alſo the Animal motions.

Which being thus propoſed and deduced by him, he endeavours to ſatisfie the objections that may be made againſt this Hypotheſis; for which, and many other particulars, we refer to the Author himſelf.

NOTE,

AT the end of *p.* 2125. the *Reader* is deſired to add, to prevent all miſtakes, what the Author of that Letter ſignified *April* 21. 1671. to the *Publiſher*, ſince that was Printed, *viz.* That in a very ſharp Froſt the Bleeding is ſtop'd till the weather begins to change; but in a moderate Froſt, though it ſtop in the night, yet in the day-time, if the Sun ſhines out, the Trees will bleed, though the Froſt continue. What we ſaid in our Letter, Printed N°. 57. *p.* 1166. *l.* 45. that Cold did not promote but hinder bleeding; we find holds true, if the Cold be without Froſt.

Beſides, *p.* 2126. at the end of Mr. *Willoughby*'s Letter may be added, what he further imparted in the above ſaid Letter of *Apr.* 21. *viz.* That ſince his laſt, he had made tryal upon *Walnut* and *Sycamore* as to the tranſmitting of Water, and found, that the water runs through both; but nothing ſo faſt as thorough *Birch.*

ERRATA. In Numb. 69. *p.* 2091. *l.* 24. *r. and purſe.* In this Numb. 70. *p.* 2128. *l.* 17. *r.* 9th *inſtant.* *p.* 2130. *l.* 3. *r. deſcent.*

LONDON,
Printed for *John Martyn*, Printer to the *Royal-Society.* 1671.

PHILOSOPHICAL TRANSACTIONS.

May, 22. 1671.

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Some Conſiderations upon Mr. Reeds Letter; *printed in N. 70. ſhewing, in what ſenſe the Sap may be ſaid to* deſcend, *and to* circulate *in Plants; and the Graft to communicate with the Stock: As alſo, what choice of Apples for the delicacy of the liquor in peculiar ſeaſons; and for eaſie and ſpeedy propagation:* Pears *for ſome* Lands *proper; their choice for manifold Uſes, eſpecially for pleaſant, or for laſting liquor; and how to be planted, and order'd for the beſt advantage. The beſt Seaſon for* Tranſplantation. *An* Apiary *or diſcipline of Bees, recommended for publick benefit; all by Dr.* John Beal *in a* Letter *to the Publiſher of* May 13. 1671.

Sir,

I Am glad, you have my honoured Friend, Mr. *Reed's*, Advertiſements; for he is a perſon of ſure veracity and much experience, and diſdains not (for his diverſion and recreation) to practiſe, with his own hands, inoculations and the finer kinds of graftings. And whatever becomes of his expreſſions for the *Deſcent of Sap*, his Inſtances and Experiments annexed are very much obliging. You have publiſhed my apprehenſions as to that point; and no wonder, if the effects, which Mr. *Reed* mentions, do follow from that correſpondence in all parts of the whole Plant, (which is by me acknowledged,) eſpecially, ſince by the leaves, and all the pores in the branches, and body, the Plant draws a kind ſuſtenance from the Sun, Air and Dews, as by the roots from the ſucculent ſoyl. And as the channels (which I may call the Conduits and Strainers) of ſeveral Stocks and Cions's do differ, ſo may ſome change of the liquor be made by ſeveral kinds of Diſtillation; as Spirit of Wine is ſooner rectified in ſome kinds of winding Tin-Inſtruments, than in a plain perpendicular one.

And from the fore-noted difference of Stocks, and the differing grains of the Roots and Timber, as alſo from the differing Leaves (if accurately inſpected, and conſidered,) we may in time perhaps diſcover ſome particular cauſes of the differing Sap, Fruit and Bloſſoms. And it would become the accurateneſs of this Age, in which ſo many are expert in Draughts, and in Chalcography, to annex to the figure of Plants, the texture and particular grains of each root, ſtem, and branch, both for ornament, and to ſuggeſt further inſtructions, whileſt we learn their taſts and other qualities.

'Tis about fifteen Years ſince I publiſhed a hint, how to diſcover by the Colour, Figure, Tenderneſs, and aſperities of the Leaves of young Apple-Plants, and Crabs, firſt appearing in the Spring, which Plant would yield the more delicate, and which the more auſtere fruit, and liquor, to ſeveral kinds and degrees of delicacy and auſterity, fatneſs and inſipidneſs, and vigour or briskneſs. And this I think allows a conſideration for ſome efficacy, or ſign (at leaſt) of change or operation in the *Deſcent of Sap*. But as far as I dare, or did deny the deſcent of Sap, I meant it in the *vulgar* ſenſe of that expreſſion, *viz.* the main quantity of Sap, which aſcends in the Spring, and is gradually hardened into leaves, bloſſoms, fruit, timber, in ſuch manner as the Oſſification in young Animals is deſcribed by Dr. *Kerckringius* in your laſt Tract of Num. 70. 'Tis a large quantity of Sap, which is expended on the fruit and growth of ſome Trees, on Acorns, Wallnuts, Cheſnuts; and this returns not to the root in winter, yet conſiſts well with the Sentiment of the *Circulation* of the Sap, which in ſome ſeaſons may run the round more ſwiftly than in other: neither do I diſcern, that this makes any oppoſition to Worthy Mr. *Reeds* intentions.

I have long ago publiſhed, and do here again confirm what Mr. *Reed* remarks, that a dull and inſipid Apple is made more guſtful by being grafted on the ſtock of the harſheſt Crab, and an auſtere Apple ſomewhat mitigated on a ſtock of gentler fruit. And I willingly embrace this occaſion to offer my vote, that the *Genet-moyles* were as well known, and as well ſpread all over England, as the Red-ſtrake now is. It would be a great eaſe to the vulgar Husbandman, who (without expences, curioſity, care, or troubling of grafting,) may by the knotted branches propagate them in ground that deſerves not to be called fertile, as they do in the Rye-land, and Gorſty ground in *Wales*; and the Cider made of the fruit (which when perfectly ripe hath a peculiar fragrancy,) is ſo delicatly agreeable for tender palats, that I was once guilty of giving it publickly the precedence before any Red-ſtrake; and I had frequently the ſofter ſex on my ſide, till the heat of *July* did too often alter the caſe. And there is a Summer-Apple well known to Mr. *Reed* by the name of *French Cornel*, early ripe, and very richly full of a moſt pleaſing liquor, which I dare extoll for a moſt delicious beverage, before the ordinary time for Cider comes in. I do not know, whether by art it can be preſerved for durance. 'Tis a ſmall tree, all the branches criſped, and curled, full of knots at every turning, and apt to grow by any branch, that is cut off below the knot. It proſpers beſt in a good mould, better than that of the common fields; yet in the dry Rye-land it bears plentifully every ſecond year, and when one of theſe trees fails, the next of the ſame kind may have a full burden; I did not find all of that kind to agree in the year of forbearance.

And becauſe I am fitter and prompter to ſerve for the *benefit* of many, than for any *curioſity*, I crave leave further to advertiſe, that ſome ſoyl which doth hardly bear Apples, does moſt kindly bear Pears; and there is a great variety of Pears to humor every palate, ſome early ripe, ſome long laſting, and for all ſeaſons of the year, ſome to be rolled,baked or dried,or otherwiſe to be preſerved, which may as well be had from our Eaſt-Countries, as from *Worceſterſhire*, *Herefordſhire* and *Salop*; but my chief aim here is for thoſe Pears which yield the richeſt, wholeſomeſt, and moſt winy liquor in great adundance, and at good certainty; of which there are many excellent kinds in the confines between *Worceſter* and *Hereford* from *Powick* to *Bosbury*, where the Bareland-pear (mentioned by Mr. *Reed*) grows in the common arable field; that, and ſome other pears of uncertain names in *Powick* do yield a very ſtrong and long laſting liquor. The Horſe-pears, as there they call them, the white and the red of ſeveral kinds, yield abundance of pleaſant liquor. The *Ailets* great and little, wild and gentle, the *Linten pear*, *Lullam-pear*, *Squaſh-pear*, have their peculiar excellencies for liquor, and ſome of them for the largeneſs of the Tree; yielding conſtantly ſome hogſheads of liquor yearly. Where the ſoil hath not been tryed, and found kindeſt for *Apples*, 'tis the ſureſt way to plant Pears alternatively, and where the liquor of Pears is weak, or leſs laſting, this may be helped by a gentle mixture of Crabs, or of the harſheſt *Apples* to humour all palats, and for a help to the Stomach, the mixture being made in the time of grinding the fruit together: and thus, when the better ſoil is too ſhallow for *Apples*, but receives Pears kindly at a greater depth, a hedge-row of Crabs, or wild auſtere apples, raiſed on the mounds and ripening in the ſame ſeaſon, will, by well ordering it, afford ſuch a perfect remedy, that judicious palats may be deceived, and take it for the beſt Cider. I muſt here give notice, that Sir *W. S.* recommends the *Hamlin-apple* of *Devon* for Cider equal to the beſt, if not excelling. Theſe diſquiſitions of the choiceſt fruits for drink, are modern, and in my memory were ſcarcely regarded in any part of *England* that I could hear of. For the beſt ſeaſon to *tranſplant*, Dr. *Lauremberg* a perſon of much experience, and no leſs learned in the beſt old *Authors*, agreeth punctually in all circumſtances, and for the like reaſons, with the fore-noted worthy Gentleman, that Plants, which cannot well bear the hardſhip of the Winter, ſhould be tranſplanted in the Spring; but that ſuch as are able to bear the extremity of a cold winter, ſhould be tranſplanted in *Autumn*. In this only he differs, that he ſaith, *Poma, pira, ceraſa vulgaria, coryli, oxyocanthi, pruna*, &c. *facile frigus ferunt, & Autumno tranſplantari optimo ſucceſſu ſolent*: and then for the Spring he refers *juglandes, perſica, abricoca, aliquot ceraſorum genus*. *Lauremb. de Hort. cult.* l. c1. 28. I think, where he wrote and practiſed, is as cold a Country as *England*: but the more we are obliged for theſe latter Experiments, and for the friendly and ſeaſonable caution to decline adventures againſt the rage of winter. On the ſudden I ſee no good reaſon, why we ſhould expoſe any Plants to the hazard of the winters cruelty, ſince tender plants proſper infallibly by a Vernal tranſplantation; yet I muſt tell you, 'tis an old Engliſh and a Welſh Proverb concerning *Apples*, Pears, and the Haw-thorn-quick, Oaks; *Set them at Allhallontide, and* command *them to proſper*; *ſet after Candlemas, and* intreat *them to grow*: Mr. *Reed's* pleaſant obſervation of the prudence and ſagacity of *Bees*, invites me to ask, why we have ſo few *Apiaries* in *England* according to Mr. *Mewe's* modell, repreſented in *Hartlib's Common-wealth of Bees, Pag*. 48. &c. which gave him the entertainment at any time to view their Mechanical skil, Chymiſtry, Induſtry, Loyalty, and Diſcipline through the glaſs-windows of his Hive, and paid him alſo wax and hony worth twenty nobles yearly at the leaſt. *I* wiſh this Royal and Loyal in-

ſect had a juſt and full number of prompt diſciples all over *England*, which would offer no worſe ſacrifice upon our publick *A*ltars, then Hony and Wax, the good example of Piety, Devotion, *A*rts and *I*nduſtry.

An Extract of a Latin Letter, *written by the learned* Signior Malpighi *to the Publiſher, concerning ſome A*natomical *Obſervations, about the Structure of the* Lungs *of* Froggs, Tortoiſes, &c. *and perfecter Animals; as alſo the Texture of the* Spleen, *&c.*

D*Eſideratiſſimus de Reſpiratione Doctiſſimi* Thruſtoni *libellus tandem ad meas devenit manus; ubi propugnatam vidi meam, de Pulmonum ſubſtantia *, ſententiam. Quapropter Te anxie rogo, ut ipſi meo nomine officioſam dicas ſalutem, plurimaſque eidem gratias agas pro ſpontanea & honorifica meorum dictorum tutela.*

* *Vid.* D. Thruſton. *in Diatriba de Reſpirationis Uſu primario,* p. 42. & p. 143, 144.

Miratus ſum valdè, Animadverſionum *Authori in Teſtudinum,* Lacertarum *& Ranarum Sectionibus non occurriſſe Commercium inter Bronchia, & Pulmones, quos* Veſiculas, *à laxitate exterioris Pulmonum membranæ obortas, vocat; cùm ſanè immiſſâ in Tracheam fiſtulâ, & ſimul inſufflato Aere, Pulmones, eidem Tracheæ appenſi, hinc inde circa Cor turgeant; quod & ad libitum animalis frequenter accidit: Hi etiam, dum Aere turgent, ſi filo innodentur ut ſicceſcant, ſecti patenter oculis Cellulas & Veſiculas, evidenter membraneas, exhibent. Et licèt in* Ranis *brevis ſit Bronchiorum proceſſus, à* Larynge *tamen bini ductus, ſemi-circularibus aliquot annulis conflati, in membraneas veſiculas hiant; atque ita ſuccedit Inſpiratio & Exſpiratio. At in* Teſtudine, Lacertis *& ſimilibus, oblonga Trachea in binos ſubdiviſa ramos, Aerem pulmonaribus Veſiculis ſubminiſtrat. Scio, in* Ranis, *propè os, hinc inde binas interdum turgentes erumpere* veſiculas *(procul tamen à Pulmonibus,) quæ buccæ ſunt Appendices, & Aere interdum, à pulmonibus in oris cavitatem Expiratione propulſo, foras exilire.*

*Circa exaratos Pulmones reticularem Muſculum locari ſcias, cujus carneos plexus, ſinus, & veſiculas ambientes aliàs ruditer delineavi. Hujus mirabilis contextus patet in Ranis, & Lacertis præcipuè; nam multiplices carnei lacerti per longum producuntur, & tranſverſaliter elongatis fibris invicem continuantur; intermediæ verò areæ reticularibus carneis plexibus ulteriùs occupantur, non abſimili ritu ac in Arborum foliis accidit: Retis autem enarrata hæc minora ſpatia rectis poſtremo fibris, quaſi brevibus tendinibus, pervaduntur. Mirabilis hic Muſculus non exteriorem tantùm Pulmonum ambit regionem, ſed interiores quaſcunque veſiculas & ſinus circumdat, ita ut ſuo motu ſingulas pulmonis partes comprimendo, Expirationem Sonumque promoveat. Hæc eadem ſtructura in pulmonibus Perfectorum animalium proportionaliter obſervatur, & in A*gnorum *extremis præcipuè lobulis, Aere turgidis, & adhuc mollibus, patet.*

Hujus occaſione communicandum Tibi duxi, Lienis *fibras, quæ tot ingenia torſere, nequaquam* nerveas (*quod & aliquando ipſe autumavi*) *ſed* carneas *eſſe, ita ut ex carneo exteriori involucro, & productis tranſverſaliter fibris, mirabilis fiat Muſculus, Lienis cellulas comprimens, quo ſanguis per Splenicum ramum propellatur non abſimili ſtructura ac ritu, qualis in grandioribus Cordis auriculis obſervatur: Carnei etenim lacerti, per tranſverſum ducti, ſuarum fibrarum implicatione Rete efformant, membraneas cellulas comprimens, ſuiſque extremis finibus, mirabiliter productis, carneum involucrum conſtituunt.*

Parùm abſimili ſtructurâ Equinos *præcipuè* Teſtes *Natura ditavit; interior quippe ipſorum tunica* Carneas *fibras, ſeu extenſum muſculum, in ſui meditullio, unà cum varicoſis vaſis continet, quæ diverſas inclinationes, ut in Liene, habentes, per tranſverſum productæ, & reticulariter implicitæ, Inteſtinulorum congeriem firmant & comprimunt. Pauca hæc & inordinata in mei amoris & obſequii teſtimonium habeas, precor. Vale, Dabam* Bononiæ *die* 20. Februarii 1671.

A Narrative of ſome Obſervations lately made by certain Miſſionaries in the Upper Egypt; *communicated in a Letter written from* Cairo *the ſixth of* Januar. 1670.

BY yours of *April* the 20th laſt I find, that you deſire to hear ſome news concerning my Voyage in the *Upper Egypt*. I am very ready to give you that ſatisfaction, provided you make our friends ſhare in it. I ſhall therefore tell you, that I have ſpent three months time in that voyage, accompanied with my Brothers, the F. *Charles* and *Francis*, alwaies aſcending upon the *Nile* as high as 300 leagues above this City, being two daies journey on this ſide of the Caſcata's of the *Nile*, & where never any French-man hath been within the memory of man. I there admired ſtore of Idol-Temples yet entire, together with very ancient Pallaces filled with Statues and Idols. I counted in one place alone 7 *Obelisks* like thoſe at *Rome*, and about 120 Columns in one Hall, of the bigneſs of five Braſſes; full within and without, from the top to the bottom, with Hieroglyphic Letters, and with Figures of falſe Deities. I found Statues of white marble; and ſome of black, of the bigneſs of three perſons, with a ſword on their ſide, and of an hard ſtone; namely, a Man and a Woman, at the leaſt of the height of eight fathoms, though ſeated in chairs; but well proportioned: And two others of black marble repreſenting women, with Globes on their head and extravagant coverings thereon, which were two foot broad from one ſhoulder to the other.

If I had had more time allow'd me to make this Voyage, or had not been obliged to ſtay long time upon the account of our Miſſion, in ſuch places where nothing conſiderable was to be ſeen, I might have made very curious Obſervations. There are places where I could not ſtay to view them but half an hour, which required very well the ſtay of many hours, and we lighted not but in two places, where Antiquities were to be ſeen, one whereof is called *Lozor*, and the other *Candion*, which is a very ancient Caſtle, eſteemed by the Tradition of the Country to have formerly been the Reſidence of a King. Nor indeed is this hard to believe even before one enters into it, conſidering in the advenues of the ſaid Caſtle a great number of *Sphinxes* ſtanding in a row, and turning their head towards the Alley. 'Tis known that this is an Idol having the Head of a Woman and the Body of a Lion, which was once a famous Deity among the Egyptians. They are diſtant from each other about two paces, and are 20 feet long. I walk'd in four Alleys ending at four Gates of the Caſtle; and for ought I know there may be more of them, ſeeing I went but half round the Caſtle, which is very ſpacious. I reckon'd 60 of them on one ſide of one Alley, and as many over againſt it; and 51 in another Alley; all well meaſur'd. The Alleys are of the largeneſs of a Pal-mall: the Gates of that Caſtle are of an extraordinary height cover'd with moſt excellent ſtones. Meaſuring one which maketh the height of one of them, I found it 26½ foot long, and proportionably thick. I believe, that there are above a million of Figures in profil, none in front: I ſpeak of thoſe that are graven on the Walls and Pillars. I ſhould have needed a whole Month to obſerve all the particulars of that place. I did content my ſelf to draw only the poſtures of a douzen of the moſt extravagant *Dæmons* together with their Adorers of both Sexes; and ſome Frontiſpieces of Temples, which are not very rich in Architecture, but built of very fine ſtone. That which moſt pleas'd me was the ground, where the Azure and the other Colours, which are like enamel, appear as freſh as if they had been laid on but a month before. There are Temples ſo ſpacious, that 3000 people may ſtand on the roof with eaſe. In the ſame Caſtle there is a Pond, the water whereof is bitter, ſet about with fine ſtones. This water is ſaid perfectly to whiten Linnen all alone; which I tried not, but we dipp'd our handcherchief in it, which kept the ſent of Soap for four or five daies.

Theſe are the only curioſities I can ſend you of our Voyage which is not the fiftieth part of what was to be ſeen: but our time being limited we only could ſtay in two *places*; our deſign not being curioſity, but to ſatisfie the charge of the Miſſion among the Chriſtian *Cophthes* of that Countrey, which are in great number there, and have many Monaſteries and ancient Churches, but poor. We have paſſed many places, where was neither Prieſt nor Church, but only the poor people like ſheep without a Shepherd. I hope ſhortly to return thither, and not to come back again

gain with ſo much haſt, after I ſhall have made a little voyage upon the Red Sea, whither I go every year to viſit the poor Slaves in the Gallies of the Turks, &c. *F. Brothais.*

Extract of a French Letter, *written by* F. Jaques Paul Babin, *a Jeſuit, to* F. Ignatius Bardy *of the ſame Company, from* Negropont, *May* 15. 1670; *and lately communicated by the* Learned *Jeſuit* Bertet *to a Friend of his in* London; *concerning the Flux of the* Euripus.

ALthough the *Euripus* be a Symbol of inconſtancy, yet hath it this advantage, that whereas the great things, which the Antients have recorded of the Cities and Rivers of *Greece*, are or appear no more in being, the *Euripus* ſtill remains what it hath been. 'Tis true, that the Town of *Chalcis* is deſtroyed, but in the place thereof we may ſee that of *Negropont* in *Eubœa*, which is ſever'd from *Bœtia* only by an Arm of the Sea, where this *Euripus* is found; over which are built two Bridges, one of Stone, the other of Wood; in the middle whereof is a Rock, on which the *Venetians* formerly built a Caſtle, which on its Gates doth yet ſhew the *Lions*, the Arms of the City.

I have not contented my ſelf with reading what Antient Writers have left us of this *Phænomenon*, who did either not ſee it or not conſider it with that carefulneſs and attention I have done, having made upon the place long Obſervations, which were found conform to thoſe intelligent Natives, of whom I made inquiry, eſpecially the Turks, that have the care of the Mills of this *Euripus*, and know all the times when the Wings and Wheels of them are to be mov'd and turn'd according as the Water of this *Streight* by its flux and reflux changes its courſe.

The *Euripus* then is a Streight of the *Ægean* Sea, ſo narrow, that a Galley can ſcarce paſs through it, under a Bridge, built between the Cittadel and the Donjon of *Negropont*. But not only this place, where the Bridge is, is call'd the *Euripus*, but alſo ten or twelve leagues on each ſide of it, where the Chanel being more large, the inconſtant courſe is not ſo ſenſible, as at the foot of the Caſtle. For three or four leagues on each ſide there are found ſix or ſeven Gulfs, wherein this water ſhuts it ſelf up, to iſſue from thence as often as it enters there; and the ſcituation of theſe Gulfs contributes to the odneſs of this flux and reflux; of which the Moon ſeems to be the principal cauſe.

There are twenty daies of each Moon, in which the courſe of the *Euripus* is regular, and ten, in which 'tis irregular; that is to ſay, five daies before and five daies after the New and Full Moon, the courſe of it is regular and ſtrong; and then you ſee there the like phænomena with thoſe of the Ocean at *Bourdeaux*. The Sea hath two Fluxes and Refluxes in twenty four hours, and every day it retardeth almoſt an hour. But there are nine or ten changes of the courſe of the water during the remaining ten daies of inequality; unleſs it blow hard, for then the courſe changeth not above ſix or ſeven times. I once ſtayed on the Mill (which is under the Bridge,) 1½ hour, and I ſaw the courſe of the water change thrice, though the wind was pretty high; and the Wheels of the Mill turn'd as often divers waies. Monſieur de la *Hogue*, a Pariſian Gentleman, being curious, ſtaied there almoſt a whole day with a Janiſſary; and the Moon being near the Full, he obſerv'd the ſame thing that happens in the Ocean. But though he deſign'd to ſtay there full twenty four hours during the irregular daies, he was diſſwaded from it for fear of the Turks, that might take him for a Spie and do him ſome miſchief.

I ſaid, that for twenty daies the Flux and Reflux is as in the Ocean, or as at *Venice*; but with this difference, that the water of the Ocean riſes many feet high; but in the *Euripus* it riſeth not much above a foot: beſides, in the Ocean 'tis obſerved, that the water in its riſing flows *into* the *ports* and *towards* the Land, and in its full runs *into* the *Main*; but in the *Euripus* when the water riſeth, it runs then into the Sea, and when it ſinks, it flows into the channel going towards *Conſtantinople*.

The ſmall Gulfs, that are on the left ſide of the port of *Negropont*, are fill'd when the water riſeth; and emptied, running towards *Theſſalonica* or *Conſtantinople*, when it deſcends. I wrote to the F. *Vabois*, deſiring him to obſerve; and he took notice of the ſame at *Conſtantinople*, *viz.* that the waters of the *Black Sea*, that come from *Conſtantinople*, drive the *Euripus* in its riſing towards the main Sea, and that there-after the waters retire themſelves towards the ſame place again whence they came.

I cauſed the ſame perſon to make another obſervation, which was, That that ſwelling of the *Euripus* which is irregular, laſted not above a good quarter of an hour, and the ſinking thereof, three good quarters, though then the water ran with more rapidity, and ſeem'd to us to come away in thrice as great plenty, than when he ſaw it riſe. I know not whether this proceeded from the wind, not being able to aſſure you, that this effect is ordinary, till I have oftner obſerved it.

Between the aſcent and deſcent there is a little interval, wherein the water ſeems to be at reſt and ſtagnating, ſo that, if there be no wind ſtirring it, bits of wood and ſtraw lye ſtill upon the water without motion.

From what I have ſaid, 'tis not difficult to reconcile the Authors that have written ſo differently of the *Euripus*. For thoſe that have ſaid, that there is nothing in it but what is ſeen in the Ocean, that is, *Two* Fluxes and Refluxes in twenty four hours, have only obſerv'd it in thoſe twenty daies of its Regularity. And the Antients have not deliver'd a falſhood, when they ſay, that there are *Seven* Reciprocations in one day, becauſe that happens when the Winds trouble and retard the Cours of the water: and I do aſſure, by often reiterated Obſervations, that when 'tis ſtill weather, the Flux and Reflux is made even to nine or ten times in a natural day.

A Relation of two conſiderable Hurricans, *happened in* Northampton-ſhire, *not above four miles diſtance from one another, within the compaſs of leſs then twelve Calendar-Months: Communicated by Mr.* John Templer *of* Braybrook *to a Friend of his in* London.

O*Ctob* 30. 1669. Betwixt five and ſix of the Clock in the evening, the wind Weſterly, at *Aſhley* in *Northampton-ſhire* happen'd a formidable *Hurrican*, ſcarce bearing ſixty yards in its breadth, and ſpending it ſelf in about ſeven minutes of time. Its firſt diſcern'd aſſault was upon a Milk-maid, taking her pail and hat from off her head, and carrying her pail many ſcores of yards from her, where it lay undiſcover'd ſome days. Next, it ſtorm'd the Yard of one *Sprigge*, dwelling in *Weſt-thorp* (a name of one part of the Town,) where it blew a Waggon-body off of the axle-trees, breaking the wheels and axle-trees in pieces, and blowing three of the wheels ſo ſhatter'd over a wall. This waggon ſtood ſomewhat croſs to the paſſage of the wind. Another waggon of Mr. *Saliſburies* marched with great ſpeed upon its wheels againſt the ſide of his houſe to the aſtoniſhment of the inhabitants. A branch of an *Aſh-tree* of that bigneſs that two luſty men could ſcarce lift it, blew over Mr. *Saliſburies* houſe without hurting it, and yet this branch was torn from a Tree, an hundred yards diſtant from that houſe. A Slate was forced upon a window of the houſe of *Samuel Templer* Eſq;, which very much bent an Iron-bar in it; and yet 'tis certain, that the neareſt place, the Slate was at firſt forc'd from, was near two hundred yards. Not to take notice of its ſtripping of ſeveral houſes; one thing is remarkable, which is, that at Mr. *Maidwells* Senior it forced open a door, breaking the latch, and thence marching through the entry, and forcing open the Dairy-door, it over-turn'd the milk-veſſels, and blew out three panes or lights in the window; next it mounted the Chambers, and blew out nine lights more. From thence it proceeded to the Parſonage, whoſe roof it more than decimated; thence croſſeth the narrow ſtreet, and forcibly drives a man headlong into the doors of *Thomas Briggs*. Then it paſſed with a curſory ſalute at *Thomas Marſtons*, down to Mr. *George Wignils*, at leaſt a fourlongs diſtance from *Marſtons*, and two fourlongs from *Sprigg's*, where it plaid notorious exploits, blowing a large hovel of peaſe from its ſupporters, and ſetting it cleverly upon the ground, without any conſiderable damage to the thatch. Here it blew a gate-poſt, fixed two foot and an half in the ground, out of the earth, and carried it into the fields many yards from its firſt abode.

In this caſe, the Scite of that part of *Aſhley*, moleſted by this wind, is conſiderable with the Poſition of the field to the then point of the compaſs, wherein the wind ſtood. About ½ a mile diſtant from the Town is a ſmall Wood on the top of an Hill, and partly deſcending into a Vale encompaſſed by Northerly and Southerly Hills; ſo that the wind may ſeem confined to the Vale as a channel before it aſſaulted the Town, and thereby enforced to ſpend it ſelf only in that glaad.

But I am not unapt to think, that ſome *flatus* from the deſcending Wood-ground might contribute to this accident, becauſe the wind continued, ſo far as men could judge, as high in the field afterwards, and the ſcite of the Town did expoſe (by reaſon of thoſe Valleys) a far greater part of the Town to this damage than was troubled, the Valley being above four or five times the breadth of that part of the Town concerned in it.

The *other* Inſtance was *Octob.* 13. 1670. at *Braybrook*, likewiſe in *Northampton-ſhire*, about eleven a Clock; when the wind, in a ſtrange ſtorm aſſaulted a Peaſe-reek in the field, uncovering the thatch of it, and leaving another within twenty yards unconcerned. Thence it proceeded alſo to the Parſonage, where it carried not twelve, ſcarce eight yards in breadth, blowing up the end of a Barley-reek and therewith ſome ſtakes in it of near five foot long: In the mean while it left a Wheat-hovel, within ſix yards of the Barley-reek, and being without all ſhelter, untouched, no part of the thatch of the hovel being ſo much as furled. Neverthelеſs it beat down a Jack-daw from the reek with that violence as forced the guts out of the body, and made it bleed plentifully at the mouth. This I ſaw, and took up in ſome company, the Daw very warm. Thence it went in a right line to the Parſonage-houſe, took off the cover of all the houſe in its compaſs. From hence it paſſed over the Town without any damage, the reſt of the Town being low in ſcituation, and went on to a place called *Fort-hill,* where it uncloathed ſo much of a Mault-houſe as lay within its line and breadth, ſo as to expoſe the Mault upon the floor to the open air.

Here may be noted, that *Braybrook* ſtands in a Valley environ'd by hills on three ſides at three quarter of a miles diſtance from it. But (what I would chiefly obſerve,) there is an Hill, called by the name of *Clack-hill*, within a mile of it, and exactly in that point of the compaſs in which the wind then ſtood; no hill in its way till the wind had paſſed over all the places it endamaged: And, which is remarkable, there have been two Earth-quakes in this Town within theſe ten years, when the then gentle Air (or Wind ſhall I call it) only vibrated upon that point of the Compaſs.

A Narrative of two Petrifications *in Humane Bodies, communicated by Mr.* Chriſtoph. Kirkby *in a* Letter *from* Dantzick, *dated April* 8. 1671.

THe following Obſervations (which to me ſeem uncommon,) were communicated to me by an Ingenious Doctor, my acquaintance, concerning *Petrification* in Humane Bodies; and although you may perhaps have others of the like nature, yet I doubt not but theſe may have their uſe, at leaſt they confirm others.

A woman of 56 years of age, unmarried, whoſe whole courſe of life had been extreamly ſedentary, was troubled, ſome years before her death, with great pains in her back, eſpecially towards the right ſide, and a continual inclination to and effective vomiting; whoſe urine, for ſome time before, was turbid, and as 'twere mingled with blood; yet totally void of ſalſuginous matter. She was under the hands of the beſt *Doctors* in this place, who adjudged that Symptom of Bloody water to have proceeded *ex præmatura ceſſatione menſium* (which left her in the fortieth year of her age;) thereby perhaps deceived, becauſe there was never either ſtone or gravel voided by her. But her laſt *Doctor* (from whom I have this relation,) adjudged it to proceed *ab affectu Nephritico & quidem graviſſimo.* This perſon, when dead of theſe diſtempers, was opened by this her laſt Phyſitian, and among many other common *Phænomena* he found the left *Kidney* filled with large ſtones, but the right wholly petrified, covered with the ordinary skin without any fleſh; the half of which (the other being broken by injurious diſſection) repreſenting ſtill the Kidney, I have ſeen, which was both maſſy and ponderous, ſo concreted by the cloſer coalition of minute ſand, which might be rubbed off by your finger.

The other was a Lad about nineteen years old, who from his Cradle was diſpoſed to a Conſumption, accompanied with continual Coughing, great emaciation and continual heat, ſo that he was reduced to a *Sceleton*, and labouring under this diſtemper died. Being opened, a great quantity of watry matter run out at the *abdomen*, of a chylous conſiſtence; moſt, yea almoſt all the glanduls of the Meſentery, through which paſs the *venæ lacteæ*, were extraordinary great and hardned beyond the hardneſs of a *Scirrhus*. The Breaſt being opened, the Lungs were found grown to it round about, almoſt inſeparable, full of purulent ulcers, but more eſpecially the left ſide, obſtructed and filled with much gravel and ſmall ſtones; yea, whole pieces of the Lungs, eſpecially the extremities, about the thickneſs of a finger and more, were hardned into a ſtony matter.

An Accompt of Four Books.

I. *Franciſci de le Boe Sylvii PRAXIS MEDICÆ Idea nova*, Lugduni Batav. 1671.

THe Learned and Experienced Author of this work, deſiring to furniſh his Auditors with a compendious *Medical Practiſe*, and to do it after the Method of that Excellent and Happy Phyſitian *Platerus*, did propoſe to himſelf to handle chiefly of the more *Simple Affections* of the Humane Body, becauſe they being well underſtood, the knowledge of thoſe that are *Complicate* will not be difficult to attain.

But conſidering with himſelf, that Mans good Health conſiſts in and is known by the Integrity and good diſpoſition of all his *Functions*; and want of Health,in and by the indiſpoſition and depravation of the ſame, he thought fit to treat of thoſe Affections, that occur in the Practiſe of Phyſitians, according to the difference of thoſe depraved Functions. And foraſmuch as theſe Functions ſerve either for the *Conſervation* of the *Individual*, or the *Propagation* of the *Species*; and the former of theſe is conveniently ſubdivided into the *Natural*, ſerving for the various change of ſubſtances taken inwardly, and the *Animal* Functions, conſiſting in the knowledge of all ſorts of things by the External and Internal ſenſes, as alſo in the various Motion of the Soul and Body; He therefore diſtributeth this whole *Praxis* into *three* Books, which treat of the *Affections*, reſpecting the Indiſpoſed *Functions* of Man. I. The *Natural*. II. The *Animal*; and *III*. Thoſe that ſerve for *Generation*.

We ſhall not enlarge here by repreſenting any particulars of this Work, but refer the Judicious Reader to its peruſal and conſideration, by which as he will doubtleſs meet with many uſeful Medical Preſcriptions and Remedies, ſo he will not find it barren of conſiderable Obſervations and Experiments relating to Natural Philoſophy, and in particular to Anatomy.

II. *Relatione dello Stato preſente dell' EGYPTO, ſcritta dal Sig. Gio.* Michaele Vanſlebio, *è dedicata al Grand Duca di Toſcana. In* Parigi, 1670. *in* 12°.

PAſſing by what this Relation obſerveth of the Political Government of *Egypt*, and the Original Language and Religion of the *Cophthes*, (which maketh a great part of the Book, but is not ſuitable with the deſign of theſe Tracts,) we ſhall take ſome notice of what it delivers concerning the Natural State and Productions of the Country, the Oeconomy of the Inhabitants,and the Magnificent Structures yet remaining there.

Firſt then the Author obſerveth, that the winter of *Egypt* is ſo mild, as to be like to the March-air of *Rome*; and that the uſual time of *Rain* is in the months of *December*, *January* and *February*, and that principally about the Sea-coaſt: Of *Tempeſts*, from Eaſter to Whitſontide, when the Wind is for the moſt part Eaſterly: Of the moſt agreeable weather, in *November* and *December*, when the Countrey is dry'd again from the *Nile* waters, and all things in a verdure, the winds gentle and the Sun tolerable: Of the violent heats, in *April*, *May*, *June*, and further till the inundation of the *Nile* cooleth the Air; which begins in *July* and ends in *September* or *October*; and proveth the great and general manure of that Country, when it ariſeth above ſixteen *braccia* or Italian Ells; beneath which when it ſtops, the Inhabitants are not obliged to pay any tribute to the G. *Signior*. The cauſe of this Inundation as 'tis principally the plenty of rain falling in *Abyſſinia*, ſo this Author taketh in the *Northerly* winds beginning in *June*, and laſting till *October*, and hindering the waters of the *Nile* from diſcharging themſelves into the Mediteranean. Theſe waters being generally eſteem'd very good, are clear'd from their turbidneſs by bitter Almonds beaten and thrown in.

When he ſpeaketh of the Animals of *Egypt*, he taketh particular notice of the great variety and abundance of *Birds* there.

When he ſpecifieth the vaſt number of *Vegetables*, he giveth an account of the various uſes of the *Dactil tree*, and particularly, that the ſtones of *Dates* are given to *Camels* in long voyages; as alſo, that Horſes as long as they feed upon *Trefoil*, have no drink given them.

Treating of the *Foſſils* of Egypt, he obſerveth, that their *Niter* is moſt abounding in the Deſert of St. *Macare*; and that about *Thebe* there is digged up ſtore of Marble, Porphyre, Alablaſter, Granates, &c.

Secondly, as to the *Oeconomy* of the Egyptians, he relateth at large their practiſe of Agriculture, and noteth, that they do not cut, but pull up their Corn, and that their Corn-harveſt is from the middle of *April* to the middle of *May*; yea that ſometimes even before the middle of *April* new bread is eaten in *Cairo*. In Villages, for want of Ovens, they bake their Bread under the hot Aſhes; and, in making their bread, ſome put *Niter* into the dough, to raiſe and colour it: which muſt be eaten new, or elſe 'tis not good. Among their Drinks they have 1. *Meath*, which, though it inebriateth, yet they are permitted to drink, though wine be forbidden them: 2. A Liquor very refreſhing, made by the *Mores* of *Licoriſh*.

As to their way of Building, diſtinctions obſerv'd in Cloathing, and their Fuel, I refer to the Authour himſelf.

Thirdly, concerning the remainders of the Antient Buildings this Author delivers many particulars, conſonant to what others have written of the ſame, as *Pyramids, Obeliſks*, *Aqueducts*, the Colcmn of *Pompey*, &c.

III. *Theod. Kerckringii M. D. Commentarius in CURRUM TRIUMPHALEM ANTIMONII Baſil. Valentini, à ſe Latinitate donatum.* Amſtelodami, 1671. *in* 12°.

THis Learned Phyſitian aſſureth the Reader in the *Preface* to this Book, that having carefully peruſed the Antimonial Treatiſe of *Valentin*, he tried all the particulars, ordered therein to be done; but that in the performance thereof he erred frequently, and was at great expences without ſucceſs, yet not by any default of the Author, but alwaies his own; eſteeming this *Baſil* to be the beſt, the ſincereſt and the cleareſt of all Chymiſts he knoweth, and engaging his credit, that he being well underſtood, you may have what ever can be hoped for from Chymiſtry; Nature having lodged, as he thinks, all her Treaſures in this Mineral, p. 42.

In his Commentary upon this *Chariot* he intimateth to have delivered ſome *Enchereſes* or Manual Operations, which, how ſlight ſoever they may ſeem, he ſaith have coſt him man thouſands; adding, that patience in ſearching, ability in expending, unwearied attention and deep meditation, are the requiſites to attain the knowledge of what is here contained.

Of the many things, that are ſaid concerning the excellent uſefulneſs of *Antimonial* Preparations, our Commentator extols in a very eſpecial manne r the *Red Oyl of the Glaſs of Antimony* of which yet he teacheth the way of preparing it but ænigmatically, though he adds, to have done it more clearly than any body declared it to him. This he affirms to be the truly *Univerſal Medicine*, being ſeaſonably and rightly uſed; alledging (p. 164 165.) a conſiderable Experiment of his own, made with it, importing, that by the means of this *Diaphoretick Oyl* alone he cured a young woman of a high *Dropſie* in twenty daies, making her on the fourth and the following days ſo to ſwim in water from ſweat, that it dropped at length through the bed upon the floor.

Beſides this, he much praiſeth, for *Chirurgical* uſes, the *Balſom* or *Tincture* of the *Sulphur* of *Antimony*, affirming upon his credit, that *Baſil Valentin* hath not given the full due to its worth; and relating withall (p.157.158.) the Hiſtory of a Cure, he performed with it upon a cancred Breaſt, that had been under the hands of ſome of the moſt expert Chirurgions, who judged it not curable but by cutting it off; which our Author prevented by the uſe and application of this Balſom, whereby within two days the matter was brought to due maturity, and, upon the joint uſe of ſome proper internal Medicines, the perſon in the ſpace of two months reſtored to perfect health.

There is another Preparation of Antimony here deſcribed, and praiſed above all the reſt, call'd by *Baſil*, his *Balſom of Life*, by which he affirms to have cured many that were altogether deſpaired of, appealing herein to the teſtimony of his Brethren. In which he is ſeconded by this Commentator, who declareth, that in this Medicine is contained not only what can be made of Antimony, but almoſt all, what can be prõſed by a Spagyriſt.

For the other particulars we ſhall leave the Reader to the careful peruſal of the Book it ſelf, and the cautious trial of the Experiments and Operations contain'd therein.

IV. *Cogitationes Phyſico-Mechanicæ de Natura VISIONIS Auth.*
Johanne Ott *Schaphuſa-Helvetio*. Heidelbergæ 1670. *in* 4°.

THis Author ſhews himſelf to be a great Admirer of *Algebra*, aſſerting this *Theſis* about it, in one of the Corollaries annexed to this Book:

Analyſis Geometrarum vera eſt methodus inveniendi & demonſtrandi; ipſiuſque ratio à Carteſio *tradita quicquid Syntheſis habet egregii, Cavallerii Methodus Indiviſibilium abſtruſi, Thomæ Hobbes Computatio veri & ſolidi, & Analyſis Veterum abſconditi, plenè continet.*

And whatever he hath perform'd, he profeſſeth he hath obtain'd by means of this *Analyſis*; ſaying thus in his Dedication.

Ex quo Teleſcopiorum Inventum mundo innoteſcere cæpit, varii variam illius rationem reddere conati ſunt, & quidem omnes ferè non-niſi ex Sphæræ ſectione Tuborum lentes polire tentârunt, donec Carteſius *tandem Sectiones Coni negotio Dioptrico aptiores eſſe demonſtraret. Non tamen defuerunt, qui contrarium aſſerendo, aut omnino inutiles eſſe affirmando, demonſtrationibus* Carteſii *obſtreperent.*

ſtreperent. Mecum verò omnium rationes perpendens, Carteſii *ratiocinium firmo talo niti, Analyſeos beneficio deprehendi; nec ulla in re hæſitavi quàm quomodo figuræ illæ in Plano delineari aut ſolidæ materiæ induci poſſent. Ipſius enim* Carteſii *machina nimis compoſita videbatur, motuſq; nimium complicatus; adeóque commiſſo in unico levi errore non poſſe non majorem ſucceſſive generari, extra dubium erat. Quamobrem machinam quandam ſimplicem conficiendam eſſe linearum Conicarum naturam requirere ſenſi. Monente autem Clariſſ.* Dom. Spleiſſio, *Mathematico ſubtiliſſ. & Aſtron. Incomparibili, operi me accinxi, ac in ſubſidium vocatâ methodo ſeu* Geometria Carteſii, *ante triennium Machinam quandam fabre-fieri curavi quæ ſimplicitate ſuâ & motûs regularitate nulli alii cederet; ea autem paucos ante menſes ultimum perfectionis ſuæ gradum conſecuta eſt. Abſolutâ autem machinâ, operi me confeſtim applicui ferro inducendo figuras Conicas, præcipuè verò Hyperbolas & Parabolas, quarum focus* 1. 2. 10. 25. 50. *pedes & ultra à vertice abeſſet. Præterquam enim quòd Inſtrumento meo cujuſcunq; generis* Hyperbolæ, Ellipſes ac Parabolæ *deſcribi queunt, ut &* Circuli *ſegmentum quodcunq;, id tamen quod machinæ perfectionem commendat, hoc eſt, quòd nullo limite claudatur ipſius Uſus; vix enim ſex pedes maximâ ſua extenſione ſuperat machina, ipſius tamen ope, Arcus* Circuli, Ellipſis, Parabolæ, atq; Hyperbolæ *delineari poterit, qui vitro inſculptus tubum* 10, 100, 1000 *pedum requirat. In proxima verò Sylvæ* Herciniæ *vitraria, modulis beneficio cuneorum confectis Vitra infundere curavi, quæ quamvis inutilia fuerint ob materiem impuritatibus ſcatentem, attamen Coni Sectiones maximè accommodatas eſſe Dioptrico uſui, ipſaſq; in Plano delineari poſſe deprehendi; ita ut mediante machina mea celeberrimam iſtam inter nobiliſſimos mathematicos agitatam controverſiam determinare poſſim.*

Concerning his Dioptrical Studies he ſaith, that remote from other Maſters and Books, by the conduct of the Carteſian *Analyſis* he hath begun to wind himſelf by a long *Calculus* out of the Labyrinth of Viſion, and by the means of *Æquations* diſcover'd divers truths both theorical and practical; among which he delivers one, which commends it ſelf both by its newneſs and uſefulneſs, which is, To contract the longeſt Tubes, without at all prejudicing their perfection, by magnifying ſo much the angle of Viſion, that the longeſt Tube ſhall not perform the like, the Lateral rays being ſo accurately ſecluded, that more of them ſhall

trouble any of the longeſt Tubes, then thoſe ſhort ones of his contrivance; of which he ſaith he hath given the grounds in this Tract: Wherein he affirms he delivers an *Hypotheſis*, whereby the *Nature* and *Manner* of *Viſion* is ſo clearly and diſtinctly exhibited, that no *Phænomenon* ſhall occur which may not be readily explained thereby; aſſuming to this end the moſt ſignal Experiments and Geometrical reaſons; and explicating withall ſome *phænomena*, conducive to the ſame; as of Firmneſs, Fluidity, Refraction, Reflection, Lucidity, Tranſparency, Opacity, Colors, and the Parts of the Eye: In the doing of which he inſerts this generous and candid Paragraph, pag. 7.

Miſſis illis occultis qualitatibus & ſimilibus, nunquam à quoquam revelandis, eorum Philoſophorum modum ſequi magis arridet, qui Regiam viam, deſertis dumetis & ſpinis, calcare malunt, ex claris & diſtinctis principiis exordium capeſſendo, atq; Experimentis Ratiocinia, in rebus præſertim Phyſicis, confirmando, in auxilium vocatis Geometrarum demonſtrationibus; ad normam Regiæ indolis, Societatis Anglicanæ; quorum inſtitutum ſi à ducentis jam ſeculis proſecutum fuiſſet Genus humanum, & amicâ conſpiratione eorum viam legiſſet, quin Naturæ penetralia intimius perſpecta haberemus, & Naturæ quaſi Domini ſalutaremur, ego nullus dubito. Nunquam tamen deſuerunt, qui id pro viribus præſtiterunt, præſertim Mathematici & Veterum Philoſophorum nonnulli; quamquam opus illud non ſit unius alteriuſve hominis, ſed plurium, imò integræ cujuſdam Societatis, ex diverſis tum nationibus tum locis coagmentatæ.

For the reſt the Reader may peruſe the Book it ſelf; of which yet I fear there are but very few *Copies* hitherto come over, if any more than that, out of which this Accompt is given.

An Obſervation concerning certain Inſect-husks of the Kermes *kind communicated by Mr.* Liſter, *May* 22. 1671. *which came to hand ſince the Printing of the former ſheets.*

I Gave you a ſhort account formerly * of certain *matrices* or Inſect-husks, of the *Kermes*-kind, which I had ſome years ſince obſerv'd on Plumb-trees. This inſtant *May* hath afforded me the ſame Obſervation, and ſome little improvement of it. I have obſerved the ſame *Patellæ* or Husks indifferently

* *March* 17. 167$\frac{0}{1}$. I find in my *Notes* (ſaith he) that ſome years ago I gather'd off our Engliſh Oak round Worm-husks very like *Kermes*-berries, but I then made no tryal of them. Again, I have often obſerved on *Plumb trees* and *Cherry-trees*; alſo on the *Vine* and *Cherry-Laurel* certain *patellæ* or flat Husks containing worms, which (or at leaſt the husks; for them only I had the opportunity of making the Experiment on) will ſtrike a Carnation with Ly and ſtand.

rently on *Vine-branches*, *Cherry-Laurel*, *Plumb-trees*, and the *Cherry tree.* The *figure* of the husks is round, ſave where it cleav'd to the branch; for *bigneſs*, ſomewhat more than half a grey pea. Theſe, I ſay, cleave to their branches, as *patellæ* do to Rocks: For *colour*; they are of a very dark Cheſnut, extreamly ſmooth, and ſhining membran-like. They adhere moſt commonly to the under-ſide of a branch or twig, and ſo are beſt ſecur'd againſt the injuries of the weather, as too much Sun and Rain. They are well faſtned to the branches ſingle, and ſometimes many in company. They are ſeldom found without vermin, as Piſmires, &c. which, I gueſs, pierce them and pray upon them. Thus much for the entire *Coccum*. If you open one of them, that is, cut off dextrouſly the top of the husk with a raſor, you'l find ſometimes five or more ſmall white magots of the Waſp or Bee-kind, that is, ſharp at both ends. When theſe are carefully taken out, you will further obſerve the remainder of their proviſion of meat, and a partition 'twixt them and the branch, where, what they excerne, is reſerv'd. Laſtly, if, when you have clear'd the Husk of Maggots, Bee-meat, and excrements, you then rub the empty membran upon white paper, it will freely and copiouſly tinge the paper with a beautiful purple or murrey. At the *date* of this, none of the Maggots were yet in *nympha*, ſo that you cannot expect from me a deſcription of the Bee or Waſp they will turn to, when they come to perfection. Before the ſeaſon be over, the Curious may ſatisfie themſelves forthwith about it, and verifie and improve it. Few *Cherry-trees*, I ſuppoſe, in any place, but will yield them ſome of theſe Berries. How-ever, if they ſhall not be ſo fortunate as to light on them, I ſhall furniſh you with them, &c.

ERRATA.

Pag. 2148. *l.* 17. *r.* it is. *p.* 2153. *l.* 15. *r.* Bæotia.

LONDON,
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Numb. 72.

PHILOSOPHICAL TRANSACTIONS.

June, 19. 1671.

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Signor *Marco Antonio Caſtagna*, Superintendent of ſome Mines in *Italy*, hath lighted in one of them upon a great quantity of that Lanuginous Stone, call'd *Amianthus*, which he knows ſo to prepare, as to render it ſo tractable and ſoft, that it reſembleth well enough a very fine Lambs-skin dreſſed white. He thickens and thins it, to what degree he pleaſeth, and thereby maketh it like either to a very white Skin, or to a very white Paper; both which reſiſts the moſt violent fire, as hath been experimented ſeveral times. Firſt, The Skin was cover'd with kindled coals, whence it took flame, but being taken out after it had been left there a while, the fiery colour preſently diſappear'd, and it became cold and white again as before; the fire, it ſeems, paſſing only thorough, without waſting or altering any thing of it; whereas ſome of the hardeſt and ſolideſt Mettals, as Iron and Copper, reduced to very thin plates, and kept as long in the fire as this ſubſtance was, would caſt Scales. Again, This Skin being made as thin as Paper, doth not only yeild that ancient and ſo much admired *Amianthus*, but is alſo perfecter than that which comes from *Cyprus*, and not inferiour to that, which ſometimes, though but ſeldom, comes out of *China*. This Paper was alſo tryed in the fire, and there it remained likewiſe without any viſible detriment, or without the leaſt change of its firſt whiteneſs, fineneſs, or ſoftneſs. Of the ſame matter this Artiſt hath wrought a *Week*, never to be conſumed as long as 'tis fed, nor altering its quality after the aliment is waſted away. And if that famous and incombuſtible Oyl were found out again, we read of, this matter would yeild the Week for that everlaſting Light, ſo much celebrated by the Antients.

The Inventor promiſeth to make further Experiments with this ſubſtance, for other diſcoveries. At the preſent he is reſolved to prepare of it ſuch a quantity of Paper, as may make a Book, and to cover it with the Skin made of the ſame, and to ſow it together with thread made of the ſame, and to write in it Letters of Gold; ſo that ſuch a Book, being made in all the parts of it incombuſtible, and everlaſting againſt the power and injuries of all the Elements, as being proof againſt the ſtrongeſt, and not being ſubject to Corruption from the other, as Water or Air, may deſerve *(he ſaith)* the name of the Book of Eternity.

Some Experiments of Signor Carolo Rinaldini, *Philoſopher and Mathematician in the Univerſity of* Padoua; *ſhewing the difference of* Ice *made* without *Air*, *from that which is produced* with *Air*: *In the ſame* Venetian Journal.

THere was taken a Glaſs-cane, about $1\frac{2}{3}$ of a Florentin *braccia* or Ell, open at one end, of which above one Ell and a quarter was fill'd with Quick-ſilver, the reſt with common water. This open end was ſhut with a finger, and inverted into a veſſel with ſtagnant Mercury; then removing the finger, the Mercury began to fall out, ſo that the aggregat of the Quick-ſilver and water falling, the water remain'd in the upper-part of the inverted cane, now free from Air. This being done, the Cane was thus expoſed to the open Air in the Month of *January*, in froſty weather, and in one night the water in it was congealed into Ice of a very good conſiſtence. Afterwards Signor *Rinaldini*, having compared this Ice with that which was produced in the open Air, found, that the Ice in the Cane was in ſubſtance altogether like that of Hail, that is, an opaque and whitiſh Body; whereas that, which was made in the Air, was tranſparent like Chryſtal. Beſides, he obſerved, that the Ice made in the Cane was heavier *in ſpecie* than that in the ambient Air: which he diſcover'd by putting it into a fluid, which was in *ſpecie* lighter than water, but heavier than Ice made in the open Air; whereby he found, that, whereas the Ice made in the Cane ſunk, that in the Air floated therein.

Which Experiment ſeems not to favour thoſe (ſaith the Author) who eſteem, that Ice, made in the common Air, is produced by the extruſion of Air latitant in the water, and by the reſolution of the more ſubtile parts, receiving in their ſtead the mixture of terreſtrial exhalations: conſidering that by the above mentioned Experiment it appears, that in the production of the Ice made in the open Air, the very Air is mixed with the Water.

But of theſe and many other things the Author (ſaith the *Journaliſt*) intends to diſcourſe in his *Natural Philoſophy*; where he means to ſhew, that 'tis not neceſſary, there ſhould be any vacuities in the Ice, and to teach, what is to be ſaid of the place deſerted by the *Mercury* whether it be void of all Body, or only of the Air, that was there.

A Letter written to the Publiſher from York, *Jan:* 10. 1670, *concerning a kind of* Fly *that is Viviparous, together with a Set of curious Inquiries about* Spiders, *and a Table of the ſeveral ſorts of them to be found in* England, *amounting to at leaſt* 33. *By Mr.* Martyn Liſter.

Sir,

I Return you thanks for your obliging Letter of the third of *January*, and have ſent you the *Viviparous Fly* and the Sett of Inquiries you deſire of me. The *Fly* is one, if not the very biggeſt, of the harmleſs Tribe that I have met with in *England*; I call them *harmleſs*; becauſe that they are without that hard Tongue or Sting in the mouth, with which the *æſtrum*-kind, or Gad-flyes, trouble and offend both man and beaſts. This Fly is ſtriped upon the ſhoulders grey and black, and as it were checkered on the tail with the ſame two colours: the *Female* may be known by a redneſs on the very point of the tail. The very latter end of *May* 1666, I opened ſeveral of them, and found two Baggs of live white worms of a long and round ſhape, with black heads; they moved both in my hand and in the un-opened Veſcicles, backwards and forwards, as being all diſpoſed in the Cells, length-ways the body of the femal, like a Sheaf.

Some ſuch thing is hinted by *Aldrovandus* lib. 1. de

Inſect. p. 57. *edit. Bonon. Tiro cùm eſſem* (ſaies he) *è grandioribus muſcis unam albis pictam lineis, ſpecie illectus, cepi; ea, in vola manus aliquandiu retenta, pluſculos edidit Vermiculos candidos, mobilitate propria inſignes.*

This is the only Fly I have obſerved with live and moving worms in the belly of it; yet I gueſs, we may venture to ſuſpect all of this Tribe to be in ſome meaſure Viviparous.

With theſe Flyes I have ſent you a paper of thoſe odd-turned Snails *, mentioned in my former Letter, which perhaps you may think will deſerve a place in the Repoſitory amongſt the rarities of the R. Society.

* See *Numb.* 50. 1011.

Some general Enquiries concerning Spiders.

1. What ſorts of Spiders to be found with us in *England*, and what is the beſt method to diſtinguiſh them and to reduce them to *Claſſes*?

2. Whether Spiders come not of Spiders, that is, of creatures of their own kind? And whether of Spiders are bred Graſhoppers, *Cicadæ*, &c. as *Interpreters* falſly make *Ariſtotle* to ſay, firſt *Aldrovandus*, and lately *Kircher* (V. *Ariſt. Hiſt. Nat.* lib. 1. cap. 19. Confer Interpret. *Tho. Gazæ*, *Scaliger*, *Aldrov.*)

3. Whether Spiders are not Male and Female; and whether Female Spiders growing bigger than the Male, be ſufficient to diſtinguiſh Sexes.

4. Whether all kinds of Spiders be alike, as to the place and number of *Penis's*; and whether all the thread-yielding kinds, are not furniſhed with a double *penis*, that is, if the *Cornicula* or certain knobbed Horns, by which all Males are beſt diſtinguiſhed, be not each a *penis*, and uſed in the *Coit* alternatively?

5. Whether the Eggs in Spiders be not formed, and very large before the time of the *Coit*?

6. What Spiders breed in Spring, and what in Autumn? What Spiders are content with one brood in the year,

and to lay all their Eggs at a time? What ſeem to breed every Summer month, at leaſt to have many ſubordinate broods; and whether the Eggs be accordingly diſtinguiſhable in ſeveral *Matrices* or Cells in the body of the Female?

7. Whether Spiders do not take their form and perfection in the Egg, and are not thence hatched neceſſarily at a ſtated and ſet time, that is, after a certain number of days, as 21, compleat Animals of its own kind? and whether the preſence of the Femal be neceſſary in order to the hatching the Eggs, at leaſt for three days, as the Ancients ſeem to affirm?

8. Whether the perfectly-round eggs of Spiders ought to be called and eſteemed Worms, as *Ariſtotle* and *Pliny* will have them, that is, in *Swammerdam*'s phraſe and doctrine, Whether they be *Puppets* in the egg, and undergo all alterations accordingly, before they be thence hatched perfect Spiders?

Hiſt. Nat. lib. 1. c. 27. lib. 3. c. 9.

9. What different colours obſervable in the Eggs of Spiders, as well of pulps as ſhell, as white, yellow, orange, purple, greeniſh? and what reſpective tinctures they will give, or be made to ſtrike with the ſeveral families of Salts?

10. Whether there be not Eggs of ſome ſorts of Spiders, which the Worms of certain ſlender Waſps (the kind in general being called by *Mouffet Muſcæ tripiles*) delight to feed on? and whether the Fable of *Veſpæ Ichneumones*, told us by the Ancients, be not to be made out by the ſame Obſervation, of theſe Waſp-worms feeding on the Eggs, and perfected into Waſps in the very webs of Spiders?

Ariſt. Hiſt. Nat. lib. 1. cap. 20.

11. After what manner do Spiders feed; whether in ſucking they devour not alſo part of their prey? How long can they live without food, ſince they ſtore up nothing againſt Winter?

12. Whether Spiders feed only of their own kind of

Creatures, as of Inſects, that is, of Flyes, Beetles, Bees, Scolopendræ and even of one another? or whether they kill Snakes too, as the Ancients affirm, for food or delight?

13. Whether ſome of them chooſe not to feed on one ſort of Fly or other Inſect only; and what properties ſuch have?

14. When, and how oft in the year they caſt their Skins, and the manner of their caſting it? What variety of colours immediately after the ſhifting the Hackle in one and the ſame ſpecies of Spider, that may, if not well heeded, make the hiſtory of them more confuſed?

15. What mean the Ancients by Spiders caſting their threads, which *Ariſtotle* compares to a *Porcupins* darting her quills, or bark-ſtarting from a Tree; and *Democritus* to Animals voiding of Excrements?

Ariſt Hiſt Nat. lib.9.cap.39.

16. Whether the thread be formed in the Body of the Animal ſuch as it comes from it; I mean, whether it be, as it were, unwound off of a ſtock or clew, as I may ſay, and which indeed to me ſeems to have been *Ariſtotles* meaning; or whether it be drawn off of a liquid maſs, as in ſpinning of Glaſs or melted Wax, which ſeems to have been *Democritus*'s ſenſe, in ſaying, it was excrement corrupted or fluid at certain times?

17. Whether the Spiders thred being glutinous, every thing ſticking to it upon the lighteſt touch, be not ſo much the reaſon of the Spiders taking his prey, as the Figure of the Net.

18. Whether a Web be not uninflammable; and whether it can be diſſolved, and in what Menſtruum?

19. What difference 'twixt the thred of Spiders, and that of the Silk-worm or Caterpillars? What ſtrength a Spiders thread is of, and what proportion it bears with the like twiſt of Silk? Whether there be not ſtronger thread from ſome ſort of Spiders than from others, as there are threds from them of very different colours, as white,

greeniſh, blewiſh, dark hair-colour, *&c*? Whether the ſtrength of the *Barmudo* nets to hold a Thruſh, mentioned in one of the *Tranſactions* *, conſiſt in the thickneſs only, or much too in the nature of the thred?

N°.50.*p*.795.

20. Whether its being to be eaſily drawn out at any time and at what length one pleaſes, and many threds together in ſpight of the Animal, be not as advantageous to the working of it up and twiſting, *&c.* as the unravelling the Cods of Silk worms.

21. Whether either the viſcous ſubſtance of their Bodies or Webs be healing to green-wounds, *&c.* as the Ancients have taught us,and we uſe vulgarly? and whether ſome one kind of them be not preferable, for this purpoſe, before others?

22. What uſe may be made of thoſe Animals, which devour Spiders for their daily food, as *Wrens*, *Red breaſt*, *&c*? Whether Spiders be a cure for ſick Poultrey, as the good Wives ſeem to experiment?

23. Whether the reaſon why Spiders ſail not in the air until Autumn, be not becauſe they are buſily employed the Summer months in breeding, or what other reaſons may be aſſigned?

The firſt article of Enquiry I have in part anſwered, by ſending you encloſed a Scheme, which, after ſome years obſervation, I have corrected and enlarged to what it is: yet I muſt acquaint you, that ſuch Draughts will be ever lyable to change and improvement, according to the meaſure of knowledge a continued Obſervation may bring us to. However it is the firſt, that I know of, that will be extant, on this ſubject, and it may be acceptable to the curious.

Tabulæ

Tabulæ compendiariæ Araneorum Angliæ; quibus accedunt eorum Tituli, è notis maximè diſcriminantibus atque inſignibus deſumpti.

Aranei
- *vel fila mittunt, ut ſunt qui*
  - *aut prædandi cauſa texunt*
    - *vel* Reticula orbiculata, *numero* IX.
      - 1. *Araneus ſubflavus, alvo paululum acuminata inflexaque.*
      - 2. *Araneus rufus, cruciger, cui utrinque ad Superiorem alvi partem velut ſingula tubercula eminent.*
      - 3. *Araneus cinereus, pictura clunium in 5 fere partes divulſa, iiſque plenis admodum.*
      - 4. *Araneus flavus, quatuor albis, præter picturam foliaceam, in clune maculis inſignitus.*
      - 5. *Araneus nigricans, clunibus ad ſimilitudinem querni folii pictis.*
      - 6. *Araneus ex viridi inauratus, alvo prætenui proceraque.*
      - 7. *Araneus cinereus, ſylvarum incola, alvo in mucronem faſtigiatâ, ſeu triquetrâ.*
      - 8. *Araneus viridis, caudâ nigris punctis ſupernè notatâ, ipſo ano croceo.*
      - 9. *Araneus pullus, cruciger in alvo plenâ.*
    - Plagas globatas, *n* IV.
      - 10. *Araneus variegatus, alvo orbiculatâ.*
      - 11. *Araneus rufus, clunium orbiculatorum faſtigio in modum ſtellæ radiato.*
      - 12. *Araneus pullus, domeſticus.*
      - 13. *Araneus cinereus macula nigra in ſummis clunibus inſignitus, minimus.*
    - Telas ſive linteamina, *n.* VIII.
      - 14 *Araneus ſubflavus, piloſus, prælongis pedibus, domeſticus.*
      - 15. *Araneus nigricans, prægrandi macula in ſummis clunibus, cæterùm iiſdem obliquè virgatis, domeſticus.*
      - 16. *Araneus fuligineus è* Craven, *inſigni candore diſtinctus, caudâ bifurcâ.*
      - 17 *Araneus ſubflavus, nigricantium macularum quadratarum catenâ in clunibus inſignitus, item cui utrinque ad clunium latera ſingulæ obliquæ virgulæ flaveſcentes.*
      - 18. *Araneus cinereus, maximus, caudà bifurca.*
      - 19. *Araneus niger aut caſtaneus, glaber, clunibus ſummo candore interſtinctis.*
      - 20. *Araneus cinereus, mollis, cui in alvo, obliquè virgatâ, macula latiuſcula è nigro rubens.*
      - 21. *Araneus plerunq; lividus, ſine ulla pictura, alvo acuminata.*
  - *aut ideo nihil texunt (niſi filorum ejaculatio ac volatûs illorſum ſpectet) cum tamen alias poſſint: nimirum Telas ad tutandum fætum aut ad hyberna, ſed apertò Marte muſcas venantur; atque ii ſunt*
    - *vel* Lupi dicti, *n.* V. *Hi verò cum ſuperioribus ſingulis octo habent oculos.*
      - 22. *Araneus ſubrufus, parvus, citiſſimo pede.*
      - 23. *Araneus cancriformis, oculis è viola purpuraſcentibus, tardipes.*
      - 24. *Araneus cinereus, alvo undulatim picta, inſignitèr procera, acuminata.*
      - 25 *Araneus fuſcus, alvo obliquè virgata.*
      - 26. *Araneus niger, ſylvicola.*
    - Phalangia, ſive aſſultim ingredientes, *n.* III. *Hi verò ſex tantum oculos habent.*
      - 27. *Araneus cinereus, ſive ex argento nigroque varius.*
      - 28. *Araneus ſubflavus, oculis ſmaragdinis, item cui ſecundum clunes tres virgulæ croceæ.*
      - 29. *Araneus ſubrufus è* Craven, *ſive Ericetorum ſive rupium.*
- *vel omnino nulla fila mittunt, ut ſunt qui plerique*
  - Longiſſimis tenuiſſimiſque pedibus donantur: *atque hi duos tantùm oculos habent, telaque ſive brachia digitata, n.* IV.
    - 30. *Araneus rufus, non criſtatus, gregatim vivens.*
    - 31. *Araneus cinereus, criſtatus.*
    - 32 *Araneus è candido nigroque varius, minima beſtiola, ſylvicola.*
    - 33. *Araneus, ut puto, coccineus, vulgò dictus a* Tan. Anglicè.

An Extract of a Letter from the ſame hand, May 30. 1671; concerning an Inſect feeding upon Henbain, *the horrid ſmell of which is in that creature ſo qualified thereby, as to become in ſome meaſure Aromatical; together with the colour yielded by the Eggs of the ſame,* &c.

Sir,

YOu may pleaſe to annex a late Obſervation to the laſt I ſent you: both being chiefly concerning the improvement of colours, and from the Inſect-kind.

There is a *Cimex* of the largeſt ſize, of a red colour ſpotted black, and which is to be found very frequently and plentifully,at leaſt in its ſeaſon, upon *Henbain:* I therefore in my private notes have formerly intitled it, *Cimex ruber maculis nigris diſtinctus ſuper folia Hyoſcyami frequens.* This Inſect in all probability doth feed upon this plant (on which only we have yet obſerved it) if not upon the leaves by ſtriking its trunk (the note of diſtinction of this kind of Inſect from the reſt of the Beetle-kinds) into them, and ſucking thence much of its ſubſtance, like as other ſorts of *Cimices* will upon the body of man, *&c*; yet upon the unctuous and greaſy matter, with which the leaves ſeem to the touch to abound. It is further obſervable, that that horrid and ſtrong ſmell, with which the leaves of this plant do affect our noſtrils, is very much qualified in this Inſect, and in ſome meaſure Aromatick and agreeable, and therefore we may expect, that that dreadful *Narcoſis*, ſo eminent in this plant, may likewiſe be uſefully tempered in this Inſect; which we refer to tryal. About the latter end of *May* and ſooner, you may find adhering to the upper ſide of the leaves of this plant, certain oblong Orange-coloured Eggs, which are the Eggs of this Inſect.

Note 1. that theſe Eggs yet in the belly of the Females are white, and are ſo ſomtime after they are layd; but as the young ones grow near their time of their being hatched, they acquire a deeper colour, and are hatched *Cimices*, and not in the diſguiſe of worms.

2. As to the colour, theſe riper Eggs yeild, if they be cruſhed upon white paper, they ſtain it of themſelves (without any addition of Salt) with as lively a Vermilion or *couleur de feu*, as any thing I know in nature; *Cochneil* ſcarce excepted when aſſiſted with oyl of Vitriol. Whether this be not preciſely ſo, I refer to the tryal and judgment of the Curious. I have ſent you a couple of the *Cimices* themſelves, though you ſcarce find a Henbain-plant without them. I add concerning the *Purple-husks*, whereof I gave you an account in my laſt, that I have found them ſince on Roſe-tree-twiggs alſo, and that very dark coloured ones, yeilding an exquiſit Murey: ſo that I conclude, that the Tree they may be found on, ſcarce contributes any thing to the colour or vertue of the husks, but they are the ſole work and product of the Mother-Inſect, indifferently chooſing a twig of any tree in order to the convenient placing and hiving her Eggs.

Some Obſervations concerning Glow-worms, *communicated by Mr.* John Templer *in a Letter to a friend of his in* London. *May* 31. 1671.

IN caſe you have met with any obſervations about the *Glow-worm*, I would intreat you to give me ſome account of them. I met with a Glow-worm laſt Saturday night, on which I made theſe Obſervations, upon putting her into a ſmall thin box (ſuch as pills are uſually ſent in.)

May 27.—71. Between 11 and 12 at night, I ſaw her ſhine through the Box very clearly on one ſide, the box ſhut; putting white paper into the Box, and the Worm into the paper, it ſhined through the paper and box both.

May 28. In the morning about 8 of the clock, ſhe ſeemed dead, and holding her in a very dark place, I could perceive very little light, and that only when ſhe was turned upon her back, and by conſequence put into ſome little voluntary motion, which happily the darkneſs of the place would not let me obſerve. After Sun-ſet that night, ſhe walked briskly up and down in her box, ſhining as clearly as the night before, and that when there was ſo much day-light that I could read in *Sylvius* without a Candle.

May 29. In the morning ſhe ſeemed dead again,at night recovered her ſelf, and ſhined as well as ever through the box,and opening the box, and holding a large Candle in my hand,the light of it did not ſenſibly diminiſh that of the Glow-worm.

May 30. *Hor.* 10. *veſper.* I ſet the box with the worm in it in my bed Chamber about four yards from my bed-ſide in a window,where I perceived it ſhine through the box for almoſt an hour; I then falling a ſleep, at my awaking I found it ſhining,and obſerved it in plain day-light for about ½ hour, and then wholly ceaſing. Looking immediately upon my watch it was near four a clock in the morning.

May 31. The worm ſhined pretty clearly in my Kitching, which you know a very lightſome room, at five a clock in the evening,at which time the ☉ ſhined glorioully into the ſame room. Give me leave to add,

1. I never ſaw her ſhine without ſome ſenſible motion either in her body or legs.

2. In her cleareſt ſhining ſhe extends her body a third part beyond its uſual length.

3. If my ſenſes fail me not, ſhe emits a ſenſible heat in her clear ſhining.

Even now looking into my box, the Glow-worm ſhined little,having contracted her body into a bending poſture, the light ſcarcely ſo big as a great pins head;upon touching of her ſhe extended her ſelf, walked in her box, and at firſt extent ſhined as glorioully as ever.

An Accompt of ſome Books.

I. *Of the USEFULNESS of EXPERIMENTAL NATURAL PHILOSOPHY, the Second Tome; by the Honourable* Robert Boyle Eſq; *Fellow of the* R. Society. *Oxford* 1671. *in* 4°.

THis Illuſtrious Author, in purſuance of his deſign, begun in the *Firſt Tome* of this Work (publiſhed many years ſince) which is to manifeſt, that Experimental Philoſophy is conducive to improve the Underſtanding and to increaſe the Power of Man, proceeds in this *Second Tome* to deliver Six very Inſtructive and Uſeful *Eſſays*.

The *Firſt* of which contains ſome General Conſiderations about the Means, whereby Experimental Philoſophy may become Advantagious to *Human Life*; not only by bringing improvements both to the *Trades* that miniſter to the Neceſſities of Mankind, and to thoſe that ſerve for Mans Accommodation and Delight; but alſo by introducing *New* ones, partly ſuch as are altogether *newly invented*, and partly ſuch as are *unknown* in the place, where the Naturaliſt brings them in requeſt. And not only ſo, but it ſhews further, that there is not any one Profeſſion or Condition of Men, (perhaps not any ſingle perſon of Mankind) that may not be ſome way or other advantaged or accommodated, if all the Truths diſcoverable by Natural Philoſophy, and the Applications that might be made of them, were known to the Perſons concerned in them: Intimating withall the Cauſes of Barrenneſs, that have hitherto kept Phyſicks from being conſiderably Uſeful; ſuch as are, *Many* falſe and fruitleſs Doctrines of the Schools; *the* Prejudices, by which men have been hitherto impos'd on about Subſtantial Forms, and the Eſſential difference betwixt Natural and Artificial things, &c; *a* too plauſible deſpondency; *a* want of belief that Phyſicks much concern'd Mens Intereſts; *want* of encouragement, of Curioſity, of a Method of enquiring and Experimenting; of Mathematicks and Mechanicks; of aſſociated endeavours, and the like.

The *Second* Eſſay treats of the Uſefulneſs of *Mathematicks* to Natural Philoſophy; ſhewing, that the Empire of Man may be conſiderably promoted by the *Naturaliſts* skill in *thoſe* Sciences, as well Pure as Mixt.

The *Third* proveth the Uſefulneſs of *Mechanical* Diſciplines to Natural Philoſophy, ſhewing, that the Power of man may be much increaſed by the Naturaliſts skill in *Mechanicks*; foraſmuch as Nature does play the Mechanitian, not only in Plants and Animals and their parts, but in many other curiouſly contrived Bodies.

The *Fourth* manifeſts, That the *Good* of Mankind may be much increaſed by the Naturaliſts Inſight into *Trades*: for the making out of which, the Author endeavors to ſhew two things; the *one*, that an Inſight into Trades may improve the Naturaliſts knowledge; the *other*, that the Natural Philoſopher, as well by the skill thus obtained, as by the other parts of his knowledge, may be enabled to improve Trades; and this *partly* by increaſing the number of Trades and adding New ones; *partly*, by uniting the Obſervations and Practiſes of differing Trades into one Body of *Collections*; *partly*, by ſuggeſting improvements in ſome kind or other of the particular Trades. And here we cannot but obſerve, that our Noble Author taketh particular care in the *Preamble* to this Book, very fully to anſwer the objection, clamorouſly preſſed by ſome, as if Tradeſmen were injured by diſcovering thoſe things, which are called the Myſteries of their Arts.

The *Fifth* maketh it out, That that may be done by *Phyſical* knowledge, what is wont to require *Manual* skill, or, that the knowledge of peculiar Qualities, or Uſes of Phyſical things, may enable a man to perform thoſe things Phyſically, that ſeem to require Tools and Dexterity of Hand, proper to Artificers.

The *Sixth* and laſt repreſents Mens great *Ignorance* of the Uſes of *Natural* things; or, that there is ſcarce any one thing in Nature, whereof the Uſes to humane Life are yet throughly underſtood; which is done, *both* to rouze up the Curioſity of Men by ſhewing how much it hath been defective, *and* to encourage it alſo, by ſhewing how much of Nature there remains yet undiſcover'd, to recompenſe as well as to exerciſe our Induſtry.

From the whole, the Attentive Reader will, beſides the advantages that are *common* to it with the formerly publiſht *Tome*, eaſily gather theſe *peculiar* uſes: *Firſt*, that it may afford many Materials for the Hiſtory of Nature; which that it might the more plentifully do, the Author hath purpoſely on ſeveral occaſions added a greater number of *Inſtances*, than were abſolutely neceſſary for the making out of what he intended to declare or prove. *Secondly*, it may afford ſome Inſtructions, Advices and Intimations to promote the Practical or Operative part of Natural Philoſophy in divers particulars, wherein Men have been either not able, or not ſollicitous to aſſiſt the Curious. *Thirdly*, it may enable Gentlemen and Schollars to converſe with Tradeſmen, and benefit themſelves (and perhaps the Tradeſmen too) by that Converſation; or at leaſt, it will qualify them to ask queſtions of Men that converſe with things; and ſometimes to exchange Experiments with them. *Fourthly*, it may ſerve to beget a confederacy and an Union between parts of Learning, whoſe Poſſeſſors have hitherto kept their reſpective skills ſtrangers to one another; and by that means bring great Variety of Obſervations and Experiments of differing kinds into the Notice of one man, or of the ſame perſons; a thing that may prove very advantageous towards the increaſe of knowledge. *Fifthly*, it may contribute to the reſcuing of Natural Philoſophy from that unhappy Imputation of Barrenneſs, which it hath ſo long lain under, and which hath been, and ſtill is, ſo prejudicial to it. And *Laſtly* and principally, it may ſerve by Poſitive Conſiderations and Directions, to awaken the Generality of thoſe that are any thing inquiſitive, and both loudly excite and ſomewhat aſſiſt the Curioſity of Mankind; from which alone may be expected a greater progreſs in Uſeful Learning, and conſequently greater advantages to men, than in the preſent State of Humane affairs will be eaſily imagined.

II. *Enchiridion METAPHYSICUM, ſive de REBUS INCORPOREIS Diſſertatio, per* H. M. Cantabrigienſem. Londini 1671. *in* 4°.

THough this Treatiſe at the firſt aſpect may ſeem not to be ſutable to make an Ingredient of theſe *Tracts*, whoſe deſign and buſineſs it is to give an account of what is tranſacting among Learned and Ingenious Men in *Phyſical, Mathematical* and *Mechanical* matters; yet, after it ſhall have been made to appear, how great a number of *Corporeal* Phænomena of the world and how many *Phyſical* Experiments are made uſe of and examined in this Book, in order to the attainment of the End propoſed by the Author, it will then, 'tis preſumed, be thought proper enough to be taken notice of in theſe Papers; it being ſo complicate with what Philoſophers look upon as the very Principles of the Effects of Nature, *Matter* and *Motion*.

The Learned Author then, worthily deſigning in this *Firſt part* to evince the *Exiſtence* of *Incorporeal* Beings, and to explain the *Nature* of them, thinks fit, for the compaſſing of that deſign, to conſider and examine divers of the chief *Phænomena* of the World, which have been by *Deſ-Cartes* and other noted Philoſophers refer'd to meer *Mechanical* Cauſes; and upon examination to repreſent, that they are in vain and falſely adſcribed to ſuch Principles, and that conſequently *Immaterial* Beings muſt needs be acknowledged to be the Cauſes of them. Which how ſucceſſfully it is by him perform'd, we muſt leave to Perſpicacious and Candid Readers to Judge: Our part only being to deliver here ſome of the principal Heads of this Treatiſe, and thereby to invite Judicious men to weigh the whole matter.

Paſſing by therefore that part of this Diſſertation, which is meerly Metaphyſical, we ſhall obſerve, *Firſt*, that our Author chargeth the famous *Deſ-Cartes* to have deliver'd a precarious and a very unphiloſophical definition of *Motion*, ſuch an one as is repugnant to Senſe and all the Rational faculties, and to have introduced ſuch Principles, whereby he might aſſert a *Neceſſity* of Exiſtence in Matter.

Next, he maketh it his buſineſs to demonſtrate, that there is ſome Extended immoveable, not imaginary, but real, Being, diſtinct from moveable Matter; which thing he maketh Spiritual and Immaterial, pervading the whole Univerſe and penetrating all Matter, and that which hath ever been and will be for ever (independently from our cogitation) and is ſomething Divine. Where it may be obſerved, that, whereas *Des-Cartes* will have that Space, which is called *Vacuum*, to be that Corporeal ſubſtance, called *Matter*, he (our Author) labours to ſhew, that that Space or Internal Place is really diſtinct from Matter, and an Incorporeal Spirit; affirming thereupon, that by the ſame door, by which the *Carteſian* Philoſophy ſeems to have endeavour'd to exclude God out of the World, he hath again introduced him, and attributing the ſame Titles to this Internal Place, that are aſcribed to God, and making the Exiſtence of this Space as eternal and neceſſary, as that of a Deity. See p. 63. 64. 66. 69. 71. 72.

From this Extended Immoveable Subſtance he deduceth, that all Spirit, contradiſtinct to Matter, is extended or hath an Amplitude, yet not Phyſically, though mentally, diviſible into parts; and would have us conſider this immenſe and immaterial ſpace and ſubſtance as ſome Repreſentation of the Divine Eſſence, yet with a preciſion from the Life and Operations of the ſame.

Then proceeding to the *Firſt Matter*, as 'tis in it ſelf, he defineth it to be an Homogeneal Congeries of Phyſical Monads or minute particles, that are not any more diviſible, and that are impenetrable, and uncapable to cohere and move of themſelves, though capable to be united and mov'd; whence he eſteems, that the Exiſtence of an Incorporeal ſubſtance can be ſufficiently demonſtrated, foraſmuch as thoſe minute particles cannot coaleſce nor move of themſelves.

Another argument to demonſtrate the Exiſtence of Incorporeal Beings he deduceth from the Succeſſive Duration of the World. And then paſſeth on to prove the ſame (which doubtleſs the Reader will be ſurpriſed at) from divers *Phænomena* of Nature, by him conceived not explicable by meer *Mechanical* cauſes; as from thoſe of Gravity; from ſome Experiments performed in the *Machina Boyliana*, as that of the Suckers aſcent with a great weight hung to it, and that of the firm Cohæſion of the two Marbles; as alſo from thoſe *Hydroſtatical* Experiments, concerning the Gravitation of water upon water; and concerning ponderous Bodies not ſinking at a competent depth, and the Body of a *Diver* not ſenſible of pain; To which he adds thoſe proofs, which he thinks may be taken, for the ſame purpoſe, from the Flux and Reflux of the Sea; from Magnetiſmes; from the Bigneſs and Figure of the Sun and Stars; from the immenſe Celerity of the Globuls in the upper part of the Vortex, and the Motion of Comets; from the nature of Light and Colours; from the generation of the Clouds and the roundneſs of Rain-drops, and the Rain-bow; from the Winds, Thunder and Lightning; from the Structure of Plants and Animals; from the Operations of the Soul; and from all thoſe *Phænomena* that are above and beſides Nature. After all which he giveth us his Definition of a *Spirit* in general, together with its Explication; where he undertaketh *both* to make it out, Why an extended *Spirit* is more capable of *Perception*, than extended *Matter*? *And*, to ſhew, How a Spirit, ſo ſubtile and penetrative, that it ſeems not capable of adhering to Matter, may yet be conceived able to move and impell Matter? And that the cohæſion of a Spirit with Matter is as intelligible, as the Union of one part of Matter with another.

III. *DIOPHANTI Alexandrini ARITHMETICORUM Libri ſex, & de NUMERIS MULTANGELIS Liber unus; cum Commentariis C. G.* Bacheti, *& Obſervationibus D. P. de* Fermat *Senatoris Tholoſani: Cui acceſſit* Doctrinæ Analyticæ *Inventum Novum*: Toloſæ, 1670. *in Folio.*

BEing inform'd, that there is an Able Mathematician here, that intends to publiſh in due time his conſiderations touching what is ſaid to be New in this Edition, we ſhall here only intimate, That in this Book, the Works of *Diophantus Alexandrinus* (concerning Numeral Algebra or Analyticks, and Figurate Numbers) as they were formerly publiſhed in *Greek* and *Latin* by *Gaſper Bachet*, with his Commentaries thereon, and ſome Treatiſes of his own, prefixed and ſubjoyned thereto; are now printed anew with the Annotations of that Excellent Senator of the Parliament of *Tholouze*, Monſieur *Fermat*; together with ſome New Inventions of His in Numeral Algebra, and the Solution of divers Numeral Problems, omitted by others: Collected out of his private Letters by R. P. *Jacobus de Billy* S. I. All publiſhed by Monſieur *Fermat*, P. Fil.

IV. *ROSETUM GEOMETRICUM, cum Cenſura brevi Doctrinæ* Walliſianæ *de* Motu, *Auth.* Thoma Hobbes *Malmesburienſi. Londini apud* Guil. Crook, *ad ſign. Draconis viridis* without Temple-bar. 1671. *in* 4°.

THe Author of this Tract tells his Algebriſt Reader in his *Preface* to him, that he will end the Controverſie he hath with him (if he pleaſeth) in this manner. *Firſt* he would have him inquire, Whether a *ſeries* of equal quantities, or of ſuch as encreaſe in a certain ration, as duplicat, or triplicat, *&c.* be a finit or infinit quantity. If he finds it to be *Infinit*; he would then have him inquire, Whether that can have any proportion to a *Finit* quantity. Thirdly, he would have him inquire, Whether a Line or any other Magnitude be not diviſible *in infinitum*; or, whether there can be a quantity infinitely ſmall? If he finds, that all quantity is ever diviſible, and that a *ſeries* of equal quantities, or of ſuch as do increaſe equally, or in a *duplicat* or *triplicat* ration, is an *Infinit* quantity, and holds no proportion to a *Finit*; and that there is no quantity infinitly ſmall; then he would have him grant, that the Doctrine of Dr. *Wallis* in his *Arithmetica Infinitorum*, and in his Book of *Motion* lately publiſh'd, is vain and falſe as founded on them; but if otherwiſe, he will yeild the victory.

The Book it ſelf treateth firſt of 21 *Propoſitions*, ſaid by the Author to have been attempted hitherto in vain: adding a Cenſure concerning Dr. *Wallis*'s two firſt parts *Of Motion* and *Mechanicks*, which hath ſome ſtrictures accuſing thoſe Treatiſes of Obſcurity and vitious Definitions; which how juſtly 'tis done, I leave to the Readers Judgment, or to the Anſwer that may be expected from the Perſon concerned.

V. *The* Prodromus *of a Diſſertation concerning a SOLID CONTAINED IN A SOLID, by* Nicolaus Steno. *Engliſh't out of Latin.* London 1671. *by* Moſes Pitt *in* Litle Britain, in 8°.

THe Author of this Curious and Learned *Prodromus* apprehending, that he might be diverted for a great while from finiſhing his intended main Diſſertation touching the *Frame* and *Changes* of the *Earth*, and the *Manner* of the *Productions* made therein; thought fit to deliver in this Tract both a Scheme and a Breviate of the ſame; foraſmuch as he doth not only delineate the Method, he hath therein obſerved, but alſo ſums up the moſt conſiderable particulars of his whole Deſign.

He ſaith then, that he hath divided that Diſſertation of his into *Four* parts. The *Firſt*, by way of Introduction, is to ſhew, that the Queſtion about *Marine ſubſtances*, found at a great diſtance from the Sea, is ancient, pleaſant and uſeful, and that, though the Solution thereof have been hitherto very uncertain, yet he hopeth he ſhall be able to bring it to a certainty. The *Second*, reſolveth this General Problem (whence he conceiveth that the Explication of all the difficulties about this Subject depends,) *viz.* *A Natural Body of a certain Figure being given, to find arguments and marks in the Body it ſelf, whereby to detect the Place and Manner of its Production*: Which Problem he affirms to have ſo reſolved, that no Sect of Philoſophers ſhall find juſt cauſe to except againſt the Principles and Notions by him ſuppoſed for its Explication. The *Third* is deſign'd to examine the Particular *Solids* included in a *Solid*, according to the Laws diſcover'd in the Reſolution of the General Problem. The *Fourth* is to repreſent, the different States or Conſtitutions of *Toſcany* (for Inſtance) aud propoundeth a way of Explicating the *Phænomena* of the *General Deluge*, not contradicting the Laws of Natural Motions.

And ſo much for his deſigned *Method*. As to the *Summ* of the moſt remarkable particulars of the whole work, it may be reduced to this.

Firſt, he comprehends, what he hath to offer about his above-mentioned General Problem, in *three* Propoſitions: *One* is, that if a Solid Body be every way encompaſs'd with another Solid Body, *that* of the two was firſt hardned, which by the mutual contact expreſſeth on its ſurface the proprieties of the ſurface of the other. The *Second* is, that if a Solid Body be every way like another Solid Body, not only as to the condition of its ſurface, but alſo as to the inward frame and texture of its parts, it is alſo like to it as to the Manner and Place of its production; excepting only thoſe qualities of Place, which are often found in it, and are not any advantage or diſadvantage to the production of the Body there lodged. The *Third* is, that a Body produced according to the Laws of Nature, is produced out of a *Fluid*. Where yet he waveth the firſt Delineations in the production of Solid Bodys, but delivers ſeveral poſitions about their Increaſe.

Having thus generally conſider'd a *Solid contain'd within a Solid*, he proceeds to a Particular examination of thoſe various Solids, that are digg'd out of ſeveral parts of the Earth, as *Incruſtations*, *Sediments* or Beds, *Angular Bodies*, *Shels* of Sea-fiſhes, the ſhapes of *Cockles* and *Plants*, &c.

From the *Change* of the *Scite* of *Beds* he giveth an Account; 1. Of the Principal Origin of *Mountains*, *Hillocks* and *Valleys*, and their various Conſtitution, Matter, Shape, &c. 2. Of the Paſſages for *Springs* and *Winds* ruſhing out of Mountains, fœtid Exhalations, hot Ebullitions; as alſo of the Changes of Hot Springs into Cold, and the Turning of the Courſe of Rivers another way; of Rivers, running in one place under ground, and riſing again in another; of whole Countries being ſwallow'd up with their Houſes and Trees; of great Lakes now appearing where Towns ſtood formerly, &c. 3. Of the many kinds of *variegated Stones*, as alſo of the Receptacles of *Minerals*; where do occur very good Obſervations.

In his diſcourſe about *Angular Bodies*, he delivers many conſiderable things about the Production of *Chryſtals* in the Cavities of Stones, about their firſt Concretion between two Fluids, or between a Fluid and a Solid, or *in* a Fluid; as alſo about the *Motion* of the Chryſtal in matter, whereby it is determin'd to the Planes of the all-ready form'd Chryſtal: Concluding from his Obſervations, that extream Cold is not the Efficient cauſe of Chryſtals; nor that 'tis the Aſhes alone burnt by fire that turn into Glaſs; nor the force of the Fire alone that produceth Glaſs; and that 'tis not beyond the power of Man, to diſcover a production of Glaſs without the violence of Fire: Where, by the by, he intimates what it is, whence depends the main cauſe of the difference of Chryſtal from Glaſs, both as to Refraction and other Operations.

From Chryſtals he paſſeth on to conſider the Angular Bodies of *Iron* and *Copper*; and ſheweth, how the production of them agreeth in ſome things with that of Chryſtals, and how it differs from them.

Thence he goes on to *Diamonds*, and obſerveth, how they alſo are produced in a Fluid incloſed in the Cavities of Stones, together with the variety of their Figure. Next, he diſcourſeth of *Marcaſites*, and delivers alſo ſeveral Obſervations about the *Selenites*, and of *Talc*, and affirms in particular, that the Solid body of *Talc* may be *diſsolv'd* into a Fluid, as being *coagulated* from a Fluid, though that diſſolution cannot at all be perform'd by Fire, foraſmuch as that part of it, which is able to diſſolve it, flyes away by the torture of the Fire.

After this he proceeds to *Shells*, both taken out of the Sea, and found in Mountains; ſhewing, of what and how they are produced, and whence proceeds the variety of colours ſeen in them; and explaining particularly, how *Pearls* are produced, as well thoſe, that being faſtn'd to the Shels are not ſo very round, as thoſe which by reaſon of the obſtruction of the pores in the Animals ſurface acquire a round figure within the pores themſelves: where occur many (in my opinion) very curious and uncommon Obſervations of the Coats of Pearls and the Shels of Pearl-bearing Fiſhes, and their difference; as alſo of the cauſe of the different Colours in Pearls; making it manifeſt, that though globuls made up of various coats may be contriv'd by Art, in imitation of Nature; yet to diſpoſe their tunicles out of a ſeries of threds by an appoſition of one to another, whence depends the native ſplendor of Pearls, will be very hard to effect.

Next, he giveth an account of *Shels lying under-ground*, affirming, that they were once the parts of Animals living in Water, and proving it by the ſole inſpection and conſideration of thoſe Shels themſelves. Which done, he maketh out the particular *Phænomena* of divers of them found in *Toſcany*. And what he hath ſaid of Shels, he affirms alſo of other parts of Animals, and of the Animals themſelves buryed in the Earth, ſuch as are the Teeth of Sea-dogs, the Back-bones of Fiſhes, various ſorts of whole Fiſhes, Skuls, Horns, Teeth, Shanks and other Bones of Terreſtrial Animals; where he informs us particularly, what to judge not only of the great number of Teeth brought away every year from *Malthas* but alſo of the huge Thigh-bones, Skuls, Teeth, and other Bones digg'd out of the Earth.

Which done, he labours to evince by a notable Inſtance, that the production of many Shels found in theſe times is to be referr'd to the times coincident with the General Deluge. And what he hath prov'd of Animals and their parts, he extends to *Vegetables* found under ground; ſhewing withal, what may be conceived of the *Figures* of Plants appearing on Stones.

He concludeth this *Prodromus* with a remarkable Information, ſhewing, How we may from the preſent Face of the Earth, by an attentive view, diſcover the former ſtate of it. Which he endeavours to make out by an Example taken from *Toſcany*; in the preſent Face of which he conceiveth, that the obvious Inequalities proclaim to an heedful Obſerver manifeſt arguments and ſigns of Six different Changes happen'd therein; the face of it having been, by his Obſervations, twice fluid, twice plane and dry, and twice un-even; which as he attempts to demonſtrate by an Induction of many places in *Toſcany* view'd by himſelf, ſo he confirms it of the Whole Earth by the Deſcriptions of various parts of the World made by ſeveral Authors; obviating the chief difficulties, that may occur about each Face and particular Conſtitution of the Earth.

An Advertiſement.

'TIs ſuppoſed, the Ingenious Reader will not be diſpleas'd to be inform'd, That *Vitruvius* is done into *Engliſh*; Containing the whole Body of *Architecture*, under which are comprehended the *Elements of Old Muſick*, *Picture in Freſco*, *Water-levelling* or *Hydroſtatics*; *Water-Organs* or *Hydraulics*; *Aſtronomy* and *Dialing*; *Mechanical Powers and Engins.* To which are to be added Illuſtrations by proper Cuts and Diagrams; with ſome Compariſon of Antient and Modern Architecture; and with certain other neceſſary Notes, compiled partly from the extant Comments, and partly by the help of other Able perſons.

The Cuts and Diagrams will be many and coſtly; ſo that the Learn'd Interpreter, Mr. *Chriſtoph. Waſe*, will have need of the aid of ſuch as are freely diſpos'd to encourage the Work, that the Book may come forth with the more exquiſite Ornaments within a Twelve-month. Of this deſign a fuller accompt may be had from Mr. *Benj. Tooke* Stationer, at the *Ship* in *Pauls Churchyard.*

ERRATA.

In *Numb.* 71. p. 2145. l. 18. r. *flatneſs* for *fatneſs*, p. 2146. l. 9. r. *trouble* for *troubling*, p. 2148. l. 16. r. *l.* 1 c. 28.

LONDON,
Printed for John Martyn, *Printer to the* Royal Society.

Numb. 73.

PHILOSOPHICAL TRANSACTIONS.

July, 17. 1671.

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A Table *of the Compreſſion of Air under water, from the depth of one foot to* 1947 *feet; Uſeful for thoſe, that dive for recovering of things loſt in water. More Communications of Mr.* Liſter *concerning the* Engliſh Kermes; *the Inſect it breeds; and the likeneſs it hath with the* Scarlet-kermes *in the Shops. An Extract of M.* Hevelius's *Letter concerning his further Obſervations of the* New Star *near the Beak of the Conſtellation of the* Swan. *An Accompt of the ſame Subject publiſh'd in* France; *together with ſome Communications touching the preſent total diſ-appearance of ſome Stars, that appeared formerly; taken notice of both by Signor* Caſſini *and Signor* Montanari. *An Anſwer of Dr.* Wallis *to Mr.* Hobbes's *Book, entituled* Roſetum Geometricum. *An Accompt of ſome Books:* I. *De MOTIONIBUS à GRAVITATE dependentibus, Auth.* Joh. Alphonſo Borello. II. *Diſſertationes duæ Medicæ de VENENO PESTILENTIALI, Auth.* Carolo de la Font. III. *Tractatus de CORDE, &c. cui acceſſit Diſſertatio de ORIGINE CATHARRI Auth.* Richardo Lower. IV. *Oratio de AFFECTUS EPIDEMII, A.* 1669. Leidam *depopulantis, CAUSIS NATURALIBUS, Auth.* Franc. de le Boe Sylvio. V. *Hypotheſis PHYSICA Nova, nec non Theoria MOTUS ABSTRACTI, Auth.* Gothofredo Guil. Leibnitio *J.V.D. & Conſiliario Moguntino.* VI. *PHILOSOPHUS AUTODIDACTUS, exhibitus in Epiſtola, ex Arabica in Latinam Linguam verſa ab* Edvardo Pocockio.

A Table *ſhewing, to what degree Air is compreſſible in Sea-water, at the depth of any number of feet from* 1. *to* 33. *feet or* 5½ *fathom, and thence for any number of* 5½ *fathoms, or* 33. *feet, to* 324½ *fathoms or* 1947 *feet.*

SOme Members of the *Royal Society* did with two different ſorts of Inſtruments make divers Experiments for finding the *Proportions* of the *Compreſſion of Air under Water*, in the Month of *July*, at *Sheerneſs*, in the mouth of the River of *Medway*, at the time of high water, where the depth was then about 19 Fathom, and the proportion of the weight of the Salt-water to that of the ſame quantity of Freſh water, taken out of the river *Thames*, was as 41 to 42.

One of the Inſtruments was a Glaſs-bottle, that held a quart of water, having a bras ring faſtned to the mouth of it, with a valve or flap, that open'd inward; ſo well fitted, that the bottle being filled more or leſs with water, none dropp'd out though forcibly ſhaken. This, let down 33 foot into the water the mouth downwards, and after a little ſtay drawn up, was found to be ſo very near half full of water, at ſeveral trials, that it was thought fit to ſtate the Compreſſion of Air at that depth to that meaſure, which at other depths was found to hold the proportions ſet down in the Table.

The Quantity of the Compreſſion was known by weighing the Bottle with the water in it, after that a forcible depreſſion of the Flap had made way for the eruption of the Compreſt Air (which kept it up even when the bottle was placed with the mouth upwards,) and then filling the bottle full of the ſame water, and weighing it again; and laſtly by weighing the bottle after the water was all let forth; the weight whereof being deducted, the firſt quantity of water weighed juſt half as much as the ſecond, or ſo near it that the fraction was not conſiderable: Whence it was concluded, that the Quantity of the Air, that filled the bottle before it was immerſed in the water, was, at the depth of 33 feet, compreſt into half the ſpace it took up before, and ſo proportionably at other depths.

This was confirm'd by repeated Experiments made with the other Inſtrument; which was a Cylinder of Glaſs, ſome two foot long, cloſe at one end, and having the other end drawn ſmall with a lamp, and turn'd down a little way, after the manner expreſſed in *Fig.* 1. This Cylinder was immerſed perpendicularly with the crooked end uppermoſt; by which, as it ſunk in the water, the preſſure thereof did gradually force in ſo much water as thruſt out the Air proportionable to every depth, till the Cylinder was ſo far immers'd, that the hole of the crooked part of it was juſt 33 feet under water; and then it being drawn up, by meaſuring from the bottom of the Cylinder to the height of the hole in the crooked part by a pair of Compaſſes, the water was found to fill the Cylinder ſo near the half, that, the motion of the ſuperfice of the water, (which then was very ſmooth) and the minuteneſs of the difference being conſider'd, it was thought fit to ſtate it to juſt half; according to which, confirm'd by the Trials at other depths, the enſuing *Table* was computed.

The Proportion of the *Weight* of Salt-water to that of Freſh, was found by weighing ſome Ounces of both in a bottle whereof the weight was exactly known, and which was made with ſo ſmall a neck, that the addition or diminution of one ſingle drop in it was diſcernible.

The *Table* is on theſe grounds computed upon the ſuppos'd Perpendicular immerſion of a Cylinder of 60 inches, cloſe at one end, and having the open end downwards. The *firſt* Column ſhews the ſeveral depths in Feet and parts of Feet. The *ſecond*, in half Fathoms and whole Fathoms; a Fathom being ſix Engliſh feet. The *third*, the proportionable parts of Compreſſion of any Quantity of Air at the ſeveral depths in the firſt 2 Columns. The *fourth* hath theſe proportions to a Cylinder of 60 inches, expreſt in Inches and parts of Inches: which may eaſily be further calculated to any other depth deſired.

And that theſe Trials may not be thought to have been made out of meer Curioſity, they will by conſidering and practical men, be found Uſeful for thoſe, who have occaſion to dive for recovering things loſt in water, foraſmuch as by thoſe Experiments they may afore hand know, to what depth they may, when they ſink in the *Diving Bell* or other fit Inſtruments, endure the Compreſſion of the Air for reſpiration; as alſo, how they may furniſh themſelves with Air in a fit veſſel for ſupply.

The

The TABLE *it ſelf.*

Depth in water.		Air Compreſt.		Depth in water.		Air Compreſt.	
In Feet.	In Fath.	to parts.	to Inches.	In Feet.	In Fath.	to parts.	to Inch.
1	0	$\frac{33}{34}$	$58\frac{4}{17}$	24	4	$\frac{33}{57}$	$34\frac{42}{57}$
2	0	$\frac{33}{35}$	$56\frac{4}{7}$	25	0	$\frac{33}{58}$	$34\frac{4}{29}$
3	$\frac{1}{2}$	$\frac{33}{35}$	55	26	0	$\frac{33}{59}$	$33\frac{33}{59}$
4	0	$\frac{33}{37}$	$53\frac{19}{37}$	27	$4\frac{1}{2}$	$\frac{33}{60}$	33
5	0	$\frac{33}{38}$	$52\frac{2}{19}$	28	0	$\frac{33}{61}$	$32\frac{28}{61}$
6	1	$\frac{33}{39}$	$50\frac{10}{13}$	29	0	$\frac{33}{62}$	$31\frac{26}{31}$
7	0	$\frac{33}{40}$	$49\frac{1}{2}$	30	5	$\frac{33}{63}$	$31\frac{3}{7}$
8	0	$\frac{33}{41}$	$48\frac{2}{41}$	31	0	$\frac{33}{64}$	$30\frac{15}{16}$
$8\frac{1}{4}$	0	$\frac{4}{5}$	48	32	0	$\frac{33}{65}$	$30\frac{30}{65}$
9	$1\frac{1}{2}$	$\frac{33}{42}$	$47\frac{1}{7}$	33	$5\frac{1}{2}$	$\frac{1}{2}$	30
10	0	$\frac{33}{43}$	$46\frac{2}{43}$	66	11	$\frac{1}{3}$	20
11	0	$\frac{33}{44}$	45	99	$16\frac{1}{2}$	$\frac{1}{4}$	15
12	2	$\frac{33}{45}$	44	132	22	$\frac{1}{5}$	12
13	0	$\frac{33}{46}$	$43\frac{1}{23}$	165	$27\frac{1}{2}$	$\frac{1}{6}$	10
14	0	$\frac{33}{47}$	$42\frac{6}{47}$	198	33	$\frac{1}{7}$	$8\frac{4}{7}$
15	$2\frac{1}{2}$	$\frac{33}{48}$	$41\frac{1}{5}$	231	$38\frac{1}{2}$	$\frac{1}{8}$	$7\frac{1}{2}$
16	0	$\frac{33}{49}$	$40\frac{20}{49}$	264	44	$\frac{1}{9}$	$6\frac{4}{6}$
$16\frac{1}{2}$	0	$\frac{2}{3}$	40	297	$49\frac{1}{2}$	$\frac{1}{10}$	6
17	0	$\frac{33}{50}$	$39\frac{3}{5}$	330	55	$\frac{1}{11}$	$5\frac{8}{11}$
18	3	$\frac{33}{51}$	$38\frac{42}{51}$	363	$60\frac{1}{2}$	$\frac{1}{12}$	5
19	0	$\frac{33}{52}$	$38\frac{1}{13}$	396	66	$\frac{1}{13}$	$4\frac{8}{13}$
20	0	$\frac{33}{53}$	$37\frac{10}{53}$	429	$71\frac{1}{2}$	$\frac{1}{14}$	$4\frac{2}{7}$
21	$3\frac{1}{2}$	$\frac{33}{54}$	$36\frac{2}{3}$	462	77	$\frac{1}{15}$	4
22	0	$\frac{33}{55}$	36	495	$82\frac{1}{2}$	$\frac{1}{15}$	$3\frac{3}{4}$
23	0	$\frac{33}{56}$	$35\frac{5}{14}$	528	88	$\frac{1}{17}$	$3\frac{9}{17}$

Depth in water.		Air Compreſt.	
In Feet.	In Fath.	to parts.	Inch.
561	$93\frac{1}{2}$	$\frac{1}{18}$	$3\frac{1}{3}$
594	99	$\frac{1}{19}$	$3\frac{3}{19}$
627	$104\frac{1}{2}$	$\frac{1}{20}$	3
660	110	$\frac{1}{21}$	$2\frac{6}{7}$
693	$115\frac{1}{2}$	$\frac{1}{22}$	$2\frac{8}{11}$
726	121	$\frac{1}{23}$	$2\frac{14}{23}$
759	$126\frac{1}{2}$	$\frac{1}{24}$	$2\frac{1}{2}$
792	132	$\frac{1}{25}$	$2\frac{2}{5}$
825	$137\frac{1}{2}$	$\frac{1}{26}$	$2\frac{4}{13}$
858	143	$\frac{1}{27}$	$2\frac{2}{9}$
891	$148\frac{1}{2}$	$\frac{1}{28}$	$2\frac{1}{7}$
924	154	$\frac{1}{29}$	$2\frac{2}{29}$
957	$159\frac{1}{2}$	$\frac{1}{30}$	2
990	165	$\frac{1}{31}$	$1\frac{29}{31}$
1023	$170\frac{1}{2}$	$\frac{1}{32}$	$1\frac{9}{16}$
1056	176	$\frac{1}{33}$	$1\frac{9}{11}$
1089	$181\frac{1}{2}$	$\frac{1}{34}$	$1\frac{13}{17}$
1122	187	$\frac{1}{35}$	$1\frac{5}{7}$
1155	$192\frac{1}{2}$	$\frac{1}{36}$	$1\frac{2}{3}$
1188	198	$\frac{1}{37}$	$1\frac{23}{37}$
1221	$203\frac{1}{2}$	$\frac{1}{38}$	$1\frac{11}{19}$
1254	209	$\frac{1}{39}$	$1\frac{7}{13}$
1287	$214\frac{1}{2}$	$\frac{1}{40}$	$1\frac{1}{2}$
1320	220	$\frac{1}{41}$	$1\frac{19}{41}$
1353	$225\frac{1}{2}$	$\frac{1}{42}$	$1\frac{3}{7}$
1386	231	$\frac{1}{43}$	$1\frac{7}{43}$
1419	$236\frac{1}{2}$	$\frac{1}{44}$	$1\frac{4}{11}$
1452	242	$\frac{1}{45}$	$1\frac{1}{3}$
1485	$247\frac{1}{2}$	$\frac{1}{46}$	$1\frac{7}{23}$
1518	253	$\frac{1}{47}$	$1\frac{13}{47}$
1551	$258\frac{1}{2}$	$\frac{1}{48}$	$1\frac{1}{4}$
1584	264	$\frac{1}{49}$	$1\frac{11}{49}$
1617	$269\frac{1}{2}$	$\frac{1}{50}$	$1\frac{1}{5}$
1650	275	$\frac{1}{51}$	$1\frac{9}{51}$
1683	$280\frac{1}{2}$	$\frac{1}{52}$	$1\frac{2}{13}$
1716	286	$\frac{1}{53}$	$1\frac{7}{53}$
1749	$291\frac{1}{2}$	$\frac{1}{54}$	$1\frac{1}{9}$
1782	297	$\frac{1}{55}$	$1\frac{1}{11}$
1815	$302\frac{1}{2}$	$\frac{1}{56}$	$1\frac{1}{14}$
1848	308	$\frac{1}{57}$	$1\frac{1}{19}$
1881	$313\frac{1}{2}$	$\frac{1}{58}$	$1\frac{1}{29}$
1914	319	$\frac{1}{59}$	$1\frac{1}{59}$
1947	$324\frac{1}{2}$	$\frac{1}{60}$	1

Extracts of two Letters from Mr. Martin Liſter *to the Publiſher, of* June 14. 1671. *and* July 5. 1671. *concerning the kind of Inſect, hatched of the Engliſh* Kermes, *formerly taken notice of and deſcribed by the ſame in* Numb. 71. p.2164; *as alſo the Uſe of theſe Purple Inſect-Husks for tinging, together with a compariſon made of this* Engliſh Purple-Kermes *with the* Scarlet-Kermes *of the Shops.*

THe *firſt* Letter, *June* 10th. I found ſeveral of the *Patellæ Kermi formes* hatched in a Box, where I had purpoſely put them. They prove a ſort, as I gueſſed by the figure of the Worm, of Bees, but certainly the leaſt, that I ever yet ſaw of that Tribe, as not much exceeding in their whole bulk the half of a Piſmire. They are very compact and thick for the bigneſs; of a cole-black colour. They ſeem to want neither ſtings, nor the three balls in a triangle in their fore-head; which yet are things to be referred to the teſtimony of a Microſcope. That which is very remarkable to the naked Eye, is a white or ſtraw-colour large and round ſpot on the back: Of their four Wings the upper pair are ſhaded or dark-ſpotted, the undermoſt pair are clear. We may entitle them, according to our cuſtom, *Apiculæ nigræ, maculâ ſuper humeros ſub-flaveſcente inſignitæ, è patellis ſive favis membranaceis, veri Kermes ſimilibus, ſuâque itidem purpurâ tingentibus, Ceraſi aut Roſæ aliarumve arborum virgis adtextis, excluſæ.*

This of the Purple-Husks, and the other Hiſtory of Scarlet-ſtaining Eggs * I preſent you as parallels of our Engliſh ſtore to *Kermes* and *Cocheneil*; I mean, additaments to encreaſe the number of agreeable tinging Materials and not Medicaments, unleſs wary and ſafe Tryal ſhall diſcover to us if they have any Medicinal qualities, as uſe and cuſtom hath made us believe the Exotic have in an high degree. One of the ſaid husks, I ſent you, adhered to a Roſe-tree-twig, and the other to a Cherry-tree. But a Roſe-buſh ſince hath afforded me ſome ſcores of theſe *patellæ*, many of which are hatched in the box I put them. It is to be further obſerved, 1. that thoſe that look the blackeſt, yield the deepeſt and beſt purple: 2. That as the Bees come to maturity, the dye ſeems to be ſpent, and the Husks grow dry. 3. That

*Of which latter, See *Numb.* 72. *p.*2176.2177.

the young ones make their way out at ſeveral ſmall holes; whereas the true *Kermes*-husk ſeems to be pierced but in one place.

The *Second*; The diſcovery of our *Engliſh Kermes* hath very much pleaſed ſome of the Curious in theſe parts; who reſolve upon Tryals of it the next ſeaſon. I think, I advertiſed you formerly, that that deep purple or violet, with which the inſides of the husks are lin'd, is much ſpent, if the husks be not taken whileſt the Bees are in *vermiculo*; and the blackeſt husks are richeſt in colour. Yeſterday in very good company we compar'd our Engliſh *Purple-kermes* with the *Scarlet-kermes* or Grains of the Shops, and found them in every point to agree ſave in the colour of their Juices; and particularly (finding in ſome parcels of the Shops many yet ſticking to little twigs of the *Ilex*,) we confidently affirm, that thoſe as well as ours are only contiguous to the Ilex-branches, and are not *excreſcencies* of the Tree, much leſs *fruit* or *berries*; by which abuſive names they have been too long known; But that they are the artifice and ſole work of the mother-Bee in order to the more convenient hiving and nouriſhment of her young.

An Extract of a Letter, written to the Publiſher by the Excellent Johannes Hevelius, *concerning his further Obſervations of the* New Star *near the* Beak *of the* Swan; *to be compared with what was formerly publiſhed of the ſame Argument in* Numb. 65. *and* Numb. *66.*

This Extract we ſhall give you in the ſame Language it was written from *Dantzick* the 1st of *May* 1671. ſt. n.

—*De reliquo mearum etiam partium eſſe duxi, Vobis quantocyus ſignificare, me nudius-tertius, die videl.* 29. April. *Novam illam Stellam ſub capite* Cygni, *ad Viam Lacteam, quam Anno proximè præterito à menſe* Junio *&* Julio, *ad uſque* 14. Octob. *conſpexeram, denuo obſervaſſe, & quidem eo ipſo loco, quo tunc temporis conſiſtebat. Interim magnitudine mihi nunc aliquanto major apparet; quippe excedit illam in Roſtro Cygni, nec non eam quæ eſt in ancone inferioris alæ Cygni, feréque illi quæ eſt in Pectore Cygni æquatur, niſi quod lumine paulò obtuſiori & rubicundiori modò luceat. Quâ verò die primùm rurſus illuxerit, affirmare adeò certò non poſſum. Nam*

cùm ferè in ea fuerim opinione, illam vel nunquam, ut plerumque factum fuit, vel tam cito non redituram, ad locum illum haud ſæpius oculos direxi; nec fieri id quidem poterat, cùm hac hyeme, nocturno tempore, circa & infra Horizontem Caput Cygni perpetuo hæſerit. Certus interim ſum, ad menſem Decemb. Januar. *imo* Februarii *haud conſpicuam fuiſſe. Etenim poſt* 14. Octobris, *quo videri deſiit, memini me eam ſæpius quæſiviſſe eo in loco, ſed nuſquam apparuiſſe. Idcirco, quantum colligere datur, vix ante initium* Martij, *quin, ſine dubio, adhuc tardius iterum prodiit. Pridie eam à reliquis quibuſdam* Fixis *ſum dimenſus. Diſtat à Cauda* Cygni, 20 *gr.* 55'. 20''; *ab ancone Alæ ſuperioris Cygni,* 17 *gr.*47'. 50''; *à Capite vero* Serpentarii, 34 *gr.* 19'. 40''; *ſic ut eodem planè loco adhuc perſiſtat, ubi antea fuerat.*

De reliquo, mihi perſuadeo, cùm ſemel, & quidem intra adeò breve temporis ſpatium redierit, illam ſæpius fore inviſibilem, rurſuſq; conſpicuam, cum incremento & decremento illius, quæ in Collo Ceti *eſt, adinſtar. Proinde operæ pretium fuerit, cùm Philoſophiæ plurimum interſit ſcire, An dentur evidentes ejuſmodi alterationes in Cælo plures, ut diligentius impoſterum ad eam attendamus; poſſitne certa quædam Hypotheſis de ejus occaſu & ortu, decremento item & incremento, à nobis excogitari? Et an ſingulis annis, ut Stella in* Collo Ceti, *ſub aſpectum veniat? An certo anni & omni tempore ſub aſpectum veniat, pari ratione; an vero cum retardatione vel anticipatione aliqua certa? Et denique, an ſemper æquali magnitudine, ſimili colore & lumine prodeat, permaneatque? Ego, dante Deo, meam operam hac in parte polliceor; reliqui Vraniæ cultores quin idem facturi ſint, nullus dubito.*

Another Accompt of the ſame Subject, Engliſhed out of the French Journal des Scavans, *printed at* Paris *the* 22th *of* June 1671.

THe *New Star*, which *Don Anthelme*, a *Carthuſian* of *Dyon*, hath lately diſcover'd *, is one of the rareſt Appearances obſerved this good while. As this perſon contemplated the Heavens at night, *June* 20th of the laſt year, deſirous to diſcover that admirable Star, which hath appear'd and diſappear'd twice ſince the beginning of this Century in the Conſtellation of

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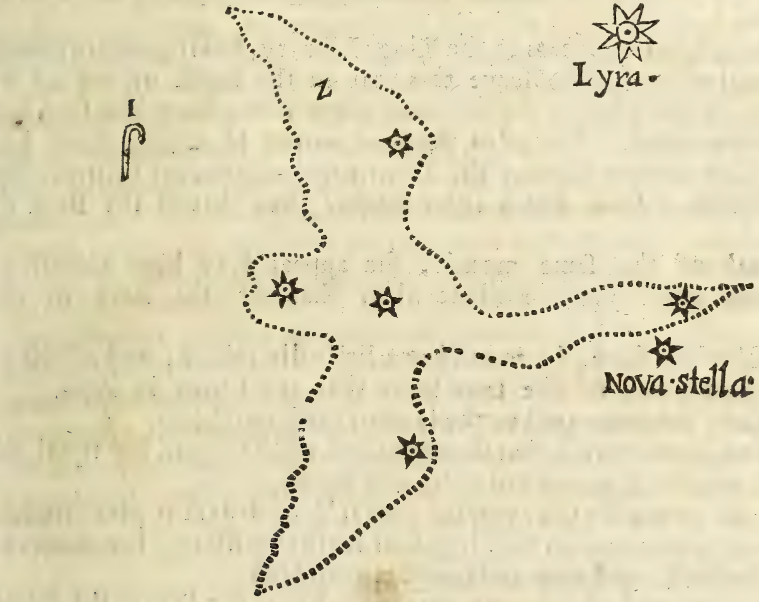
* See Numb. 65. *p.* 2092. *Where the time mentioned of the firſt diſcovery of this Star, differs from that of the relation of this* Iournal, *and is doubtleſs hence to be corrected.*

the *Swan* *; he perceived near the ſame Conſtellation a Star of the *Third Magnitude*, which he had never yet obſerved. He preſently ſignified it to the Company which aſſembleth in the Library of the King: And divers of that Aſſembly having beheld the Heavens about the end of *June* and the beginning of *July*, took notice, that there was indeed about the *Beak* of the *Swan* a *New Star* of the *third magnitude*, not to be met with in any Catalogue of Aſtronomers, although many other neighbouring Stars, that are much ſmaller, be exactly marked by them. It was ſcituate as appears in the following figure*.

* *Which is that in* Pectore Cygni.

* *See Fig.* 2.



The Obliquity of the *Ecliptick* ſuppoſed to be 23½ degrees, the *Longitude* of this Star, according to the Obſervation of Mr. *Picard*, was ———————————— 1°. 55'. of *Aquarius*.

The *right Aſcenſion* ———————— 293. 33.

The *Boreal Latitude* ———————— 47. 28.

And the *Declination* ———————— 26. 33.

It came to the *Meridian* after the Star *in* the Beak of the *Swan* ———————— 16'.44".

And before the *lucid* Star of the *Eagle* ——— 0. 27.

It was diſtant from the great Star of the Conſtellation of *Lyra* ———————— 18°. 39. 40.

From the *Beak* of the *Swan* ———————— 3. 47. 30.

And from the *Tail* of the *Swan* ———————— 20. 54. 30.

But that which is further remarkable, is, that in the beginning of *July* * this Star was obſerved to decreaſe. In the night of *July* 3d, it appear'd yet of the *Third magnitude*, but her Light was ſenſibly fainter. In the night of the 11*th* of the ſame month, ſhe ſcarce appear'd of the *Fourth magnitude*. In the night of *Auguſt* 10*th*, ſhe was but of the *Fifth*. And ſhe hath ever ſince decreaſed ſtill, ſo that at laſt ſhe became ſo ſmall that ſhe was ſeen no more.

* *Compare* Numb. 66. *p*.2028.

And ſo ſhe hath remained for ſix months without ſhewing her ſelf, and we could not diſcover her again till the night of *March* 17*th* laſt, when *Don Anthelme* ſpied her in the very ſame place, where ſhe was the year before, and found, that ſhe was of the *Fourth magnitude*.

The Aſſembly that meets in the Kings Library, having notice thereof, ſeveral of them did obſerve this Star in the night of the 2*d* of *April* laſt, finding her in the ſelf ſame place where they had ſeen her the precedent year. The 3*d* of the ſame month M. *Caſſini* found her greater than the two Stars of the *Third magnitude* that are below in the Conſtellation of *Lyra*, but a little ſmaller than that in the Beak of *Cygnus*.

The 4*th* of the ſame month, ſhe appear'd to him almoſt as great and much more radiant than that of the Beak of the *Swan*.

The 9*th* of the ſame, he found her a little diminiſh't; and almoſt equal to the greateſt of the two Stars that are below in *Lyra*.

The 12*th*, ſhe was equal to the leaſt of theſe two Stars.

The 15*th*, he perceived that ſhe encreaſed, and he found her equal, the ſecond time, to the greateſt of theſe two Stars.

From the 16*th* unto the 27*th*, ſhe appear'd of different magnitudes, being ſometimes equal to the biggeſt of theſe two Stars, ſometimes equal to the leaſt, and now and then between both.

But the 27*th* and 28*th*, ſhe was become as big as the Star in the *Swan's beak*: The 30*th*, ſhe appear'd a little clearer. And the firſt ſix days in *May*, ſhe was greater.

The 15*th* of *May* ſhe was ſeen ſmaller than the ſame Star. The 16*th*, ſhe was in bigneſs between the two Stars that are below in *Lyra*: And ever ſince ſhe hath ſtill diminiſhed.

Thus this Star hath been twice in her greateſt ſplendour, firſt on the 4*th* of *April*; and the ſecond time, in the beginning of *May*: Which we read not to have ever happen'd to any other Star.

As far as can be judged from the few Obſervations made of this Star, 'tis likely ſhe is returning about *Ten* months unto the ſame appearance; whereas that in the *Whale's Neck* maketh its revolution in *Eleven* months. As for the Star in the *Swans Breaſt*, we have as yet no certain knowledge of the period of her revolution;

yet one may aſſure, that ſhe taketh no leſs than *Fourteen years* to finiſh it.

The Diſcoveries, that have been made in the Heavens this laſt age, do evince, that Changes are not ſo rare there, as formerly was believed. If that was true, what *Pliny* ſaith, that *Hipparchus*, on the occaſion of a New Star he perceived, made an Enumeration of all thoſe which appear'd at that time, there would not be any one Conſtellation, in which ſome change were not found ſince that time, in regard there are few, wherein there be not found more Stars now than that Aſtronomer hath noted in them.

But as the little aſſurance we have of the exactneſs of *Hipparchus* his Catalogue giveth us cauſe to believe, that many Stars, which were not in that Catalogue, were yet in the Heavens; ſo we may well grant, that ſome of thoſe, that have been obſerved ſince, have not appear'd always. For, not to ſpeak of the Stars, that have been ſeen in the Conſtellation of *Caſſiopea*, in the Neck of the *Whale*, in the Breaſt of the *Swan*, and in *Serpentarius*; Monſieur *Caſſini* hath diſcover'd many other little ones *, which may very well be preſumed to be New. For example, he hath obſerv'd one of the *Fourth magnitude*, and two of the *Fifth* in *Caſſiopea*, where 'tis certain they were not ſeen before, many Aſtronomers having exactly reckon'd up the very ſmalleſt Stars of that Conſtellation, and yet not one of them mention'd thoſe three. He hath diſcover'd Two others, towards the Beginning of the Conſtellation of *Eridanus*, where we were ſure they were not yet about the end of the Year 1664, conſidering that this place of the Heavens, vvhere paſſed the then appearing Comet, was diligently beheld by many, who perceived divers other ſmall Stars, without obſerving thoſe two. The ſame hath alſo obſerved, towards the Arctick Pole Four of the Fifth or Sixth magnitude, which Aſtronomers, that always have their Eyes upon that place, vvould not have failed to note, if they had there appear'd before.

* *Compare thoſe, diſcover'd by M.* Hevelius, *in* Numb. *65 p.2091.*

Nor are we to wonder at it, that we ſee now more Stars in the Heavens than there appear'd formerly, ſeeing there appear'd thoſe formerly, vvhich are ſeen no more novv. For M. *Caſſini* hath obſerv'd, *that* the Star, vvhich *Bayerus* puts near that vvhich he marketh in the Figure of *Urſa minor*, appears no more; *that* that, which is marked A in the Figure of *Andromeda*, is alſo diſappear'd; *that* in lieu of that, vvhich is marked *υ*, at the knee of the ſame figure, there are two others more Nordward; and *that* that, vvhich is noted ξ, is very much diminiſht, The Star, vvhich *Tycho* placeth at the extremity of *Andromeda's Chain*, and calls it of the *Fourth magnitude*, is novv ſo ſmall that one can ſcarce ſee it: And that vvhich is in his Catalogue the 20*th* of the Conſtellation of *Piſces*, is novv no more ſeen; unleſs you will ſay, that it is gone down lower than *four* degrees, to the place marked o in the Figure of *Bayerus* *.

But vve are not therefore preſently to ſay, that the Stars, that have been lately diſcover'd, *were* not in the Heavens before, although they vvere not ſeen there. For, as vve now knovv, that there are Stars, vvhich appear and diſappear from time to time, ſo we have cauſe to ſuſpect, that moſt of the Stars, that vvere not ſeen formerly, or that are ſeen no more novv, or are found diminiſh't, are of the ſame nature vvith the Star in the *Whal's Neck*, and do not ceaſe to be in the Heavens, though they there appear not.

It is alſo poſſible, that theſe New Stars not only vvere in the Heavens, but even appear'd there before they vvere taken notice of as Nevv ones: And it is very probable, that 'tis alſo vvith moſt Stars, as vvith that in the Neck of the Whale, vvhich vvas not obſerved at firſt, but vvhen it vvas already of the *third* magnitude; although it hath been ſince found, that it is not really ſo great vvhen it begins to appear, but that, being very ſmall in the beginning, it encreaſeth inſenſibly untill it come to that greatneſs.

However, theſe Phenomena deſerve always to be carefully obſerved by all Aſtronomers.

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* We cannot omit taking notice here of what was communicated to the *R. Society*, about the ſame ſubject, in a Letter of *April* 30. 1670. by Signor *Montanari*, the Learn'd Profeſſor of the Mathematicks in *Bononia*, in theſe words: *Multa poſſem certè nova de Cælo Vobis tradere, quæ à multis annis obſervo, atque* Firmamento *meo* Inſtabili *exornando ac propediem evulgando ſuppeditavero; Sed unum, quod cæteris admirabilius eſt, proferam. Deſunt in Cælo duæ* Srellæ Secundæ Magnitudinis *in* Puppi Navis *ejuſque Tranſtris*, Bayero *β & γ, prope* Canem majorem, *à me & aliis, occaſione præſertim Cometæ A.* 1664. *obſervatæ & recognitæ. Earum Diſparitionem cui Anno debeam, non novi; hoc indubium, quod à die* 10. April. 1668. *ne veſtigium quidem illarum adeſſe amplius obſervo; cæteris circa eas, etiam quartæ & quintæ magnitudinis, immotis. Plura de aliarum ſtellarum mutationibus, pluſquam centenis, at non tanti ponderis annotavi*, &c.

An Anſwer of Dr. *Wallis* to Mr. *Hobbes's Roſetum Geometricum* in a Letter to a friend in *London*, dated *July* 16. 1671.

Clariſſime vir,

P*Erlegi* Hobbij *ſive* Roſetum, *ſive* Fimetum, (*nam utrumque olet*;) *in quo antiquum obtinet: Mirumque eſt, ut nec ſibi in animum inducere poſſit, nec ab amicis ſuaderi, ne ſic delirando perſiſtat ſe contemptui exponere. Notata quædam hîc tibi mitto: non quaſi metuerim, te talibus ratiociniis ſeduci poſſe, ſed ut tu, aliique, quibuſcum hæc forte communicaveris, ſine anxiâ conſideratione denuò inſtituendâ, ſtatim videatis ubi potiſſimum peccatur.*

Primæ Propoſitionis, *ſive Problematis, conſtructio* (*ut ut in re facili*) *falſa eſt*. Rectam extremâ & mediâ ratione ſecare; *docuerat* Euclides, *& demonſtraverat*, prop 30. El. 6. (*cui & alii hactenus conſenſerunt.*) *Secundùm quem, poſitâ rectâ ſecundâ* 1 R, *erit majus ſegmentum* $\frac{\sqrt{5}-1}{2}$ R; *adeoque*

ſegmentum reliquum $\frac{3-\sqrt{5}}{2}$R, *quod in totam* 1R *ductum, efficit* $\frac{3-\sqrt{5}}{2}R^2$, *quod eſt ipſum majoris quadratum.* Hobbius *autem hîc novam proponit conſtructionem; ſecundum quam (ad calculum redactam) ſegmentum majus erit* $\frac{\sqrt{:5-2\sqrt{3}:}}{2}$R. *Nam, poſitâ ſecandâ rectâ, ſeu quadrantis Radio,* $DA=1R$, *adeoque* $DH=\frac{1}{2}R$, *erit* $HX=\sqrt{\frac{3}{4}R^2}=\frac{1}{2}R\sqrt{3}$, *&* $IX=\sqrt{\frac{3}{4}R^2}-\frac{1}{2}R$, *cujus quadratum* $R^2-R^2\sqrt{\frac{3}{4}}$, *& (propter quadratum* $EI=\frac{1}{4}R^2$*) quadratum* $EX=\frac{5}{4}R^2-R^2\sqrt{\frac{3}{4}}$, *hoc eſt* $\frac{5-2\sqrt{3}}{4}R^2$: *ergo ipſa* $EX=\frac{\sqrt{:5-2\sqrt{3}:}}{2}$R, *ſegmentum majus (ſi* Hobbio *credas) ſecandæ* $DA=1R$; *adeoque ſegmentum minus,* 1R $\frac{\sqrt{:-2\sqrt{3}:}}{2}$R. *Num verò* Euclidi *(atque, poſt illum, aliis hactenus) an* Hobbio *credendum ſit, tuum eſto judicium. Sin neutrius authoritati credendum putes, ſed rationi; examinemus (ut jam* Euclidis,*) ſic* Hobbii *conſtructionem. Rectam extremâ & mediâ ratione ſecare, eſt ita ſecare, ut quadratum ſegmenti majoris æquetur rectangulo ex minori ſegmento & tota ſecanda. (Quod nôrunt omnes, nec* Hobbius *diffitetur.) Sed factum ex tota* 1R *& minori ſegmento* 1R-$\frac{\sqrt{:5-2\sqrt{3}:}}{2}$R, *eſt* $R^2-\frac{\sqrt{:5-2\sqrt{3}:}}{2}R2$; *quod æquale eſſet majoris* EX *quadrato, ſed non eſt; quippe hoc jam inventum eſt* $\frac{5-2\sqrt{3}}{4}R^2$. *Falſa igitur eſt* Hobbii *conſtructio. Et (propter hanc falſam) ruunt etiam quæ annectit* Corollarium *&* Conſectarium.

Menda in ipſius quâ *conſtructione,* quâ *(prætenſa) demonſtratione, præter minora multa, ſunt hæc ſaltem tria grandia.* 1. *In Conſtructione, pro* Deſcribatur centro D quadrans DAC ſecans FE & GH in K & X; *dici non minus potuiſſet,* ſumatur X ubivis in IG rectâ: *Nam & ſic non minus procederet;* Ducatur denique EX, *(& quæ ſequuntur omnia,) ne unâ quidem vel voce vel ſyllabâ mutatâ. Vel etiam,* ubivis in IG rectâ, utcunque in utramvis partem productâ: *Nam etiam hoc poſito, ſi* pag. 2. lin. 17. *pro* ſecans AE, *ponatur* ſecans AE ſaltem productam, *omnia ſimiliter procedent. (Quod legenti ſtatim patebit:) ut poſſit eſſe, per ipſius demonſtrationem, ſegmentum majus quantumvis longum.* 2. *In Demonſtratione: Cum oſtenderat* pag. 2. lin. 18, 19. duos rectos mXI, IXl, æquales quinque angulis mXF, FXy, yXz, zXE, EXl, *(ne inſinuato quidem, nedum probato, hos omnes eſſe inter ſe æquales:) Hinc probatum it (quaſi jam probaſſet, omnes illos quinque invicem æquales eſſe,)* angulos zEX, zXE, eſſe invicem æquales, *quia,* ſi ſecus, duo illi recti non ſic dividerentur Quinquifariam, *ſeu in quinque partes* invicem æquales, (pag 3. lin. 4, 5.) *de quo in præcedentibus nihil dictum eſt. Sunt quidem tres,* mXF, yXz, EXl, *invicem æquales; item duo,* FXy, zXE, *invicem æquales: ſed utrumvis horum utrivis illorum æqualem eſſe, neque demonſtratum eſt, neque verum.* 3. *Ubi, ex eo quod* anguli yXz, Xyr, ſint æquales; item yXr, yrX, æquales; & yXz, zEX, æquales; *infert* (pag 2. lin. 17, 18.) Quare anguli X & E trianguli zEX ſunt æquales: *Nulla eſt conſequentiæ vis: quod attendenti patebit.*

Præter hæc omnia; Propoſitionis ſecundæ *conſtructio, hanc* primæ *refutat. Nam, ſi ponamus illic totam* AG *vel* $CE=1R$, *ſegmentum majus* AB *vel* AC *vel* EF *erit* $=\frac{\sqrt{5}-1}{2}$R. *Nam ut* $AG=CE$ *ad* $CA=AB$, *ſic* CA *ad* CF. *Eſt autem* CA *ad* CF *ut* 2 *ad* $\sqrt{5}-1$, *(quod vult* Euclides: *) non, ut* 2 *ad* $\sqrt{:5-2\sqrt{3}:}$ *quod vult* Hobbii prop. 1. *Tam turpiter autem titubâſſe* Hobbium *in ipſo limine, eò magis mirandum eſt, & minùs condonandum, quòd problematis conſtructio vera (& facilis) in ipſis elementis extet* (pr.30.El.6.) *éſtque pueris nota.*

Propoſitia Tertia (*multimembris*) de Polygonis Regularibus (*cum* Conſectariis *ſuis*) *dependet tota ex hac conſequentiâ,* Quoniam chordæ *Cb, bc,* ad chordas *Ci, ic,* (*in eodem circulo*) ſunt ut 8 ad 7; propterea etiam arcus $Cc=Cb+bc$ ad arcum $CE=Ci+iE$ ut 8 ad 7 (pag.11.lin.2.) *atque in aliis proportionibus ſimiliter,* p.13.l.23,26. p.14.l.20,24. p.15.l.4. &c. *Quaſi quidem, in eodem circulo, Arcus eſſent chordis proportionales. Quod quàm ridiculum ſit, non dictu opus eſt. Hinc infert, EH* (*ſubtenſam Octantis*) *ad EF* (*ſubtenſam Sextantis*) *eſſe ut* 3 *ad* 4, (*quia Arcus ſunt in eâ ratione,*) p.30.l.23. *Item, EF* (*ſubtenſam partis Duodecimæ*) *ad EH* (*partis decimæ ſubtenſam*) *ut* 5 *ad* 6 (*in ratione arcuum*) p.14.l.19, &c. *Satis crudè.*

Prop. Quarta; *poſtquam* Circuli peripheriam curvam eſſe *oſtenditur,* curvedinémque à flexione oriri *dicitur,* curvedinúmque aliam aliâ majorem: *Oſtenſum it, primò, quòd* quam rationem habet, in eodem circulo, angulus in circumferentia (*major*) ad angulum in circumferentiâ (*minorem,*) eandem habet curvedo majoris arcûs ad curvedinem minoris. (*Putà, curvedo arcûs quadrantalis ad ſemiquadrantalis curvedinem, ut* 2 *ad* 1, *propter duplo plures in illo quàm in hoc flexiones.*) *Deinde, quod,* In diverſis circulis curvedo majoris perimetri minor eſt curvedine minoris. *Quaſi quidem non tot eſſent in majori perimetro quot in minori Flexiones. Quod abſurdum eſt. Ut ut enim in arcubus longitudine æqualibus parciores eſſent in majori circulo quàm in minori flexiones (eò quod ille minorem angulum ſubtendat:) certè in totâ perimetro majore (aut etiam partibus proportionalibus, ut quæ æquales angulos ſubtendunt,) non pauciores erunt flexiones quàm in minore. Quique totam circuli circa Terram maximi curvedinem ſimul conſpiciat, vel hujus partem aliquotam; non minus curvedinis cernet quàm in Annulo, hujuſve parte proportionali. Hæc itaque cum præcedentibus non ſatis cohærent. Sin dicat, ſe alio ſenſu hîc, alio illic, majoritatem curvedinis intelligere; Æquivocè loquitur.*

Propoſitio Quinta, (*quæ exhibet rationem Radii ad Perimetrum circuli, ut* R *ad* $10R\sqrt{\frac{2}{5}}$; *hoc eſt, ut* 10000 *ad pluſquam* 63245, *quam alii faciunt ut* 10000 *ad minus quàm* 62832;) *dependet ex hac conſequentiâ* (p.18. l.5.) Quoniam ut *DC* ad *DR* (*radius ad radium*) ſic arcus *CA* ad arcum *RS* (*ſimilem;*) ita quadrantalis arcus deſcriptus radio *DC*, id eſt, arcus *CA*, ad arcum deſcriptum (*radio DR, hoc eſt, arcum RS, ſic dicendum erat; ſed ille*) radio *RS* extenſo in rectitudinem. *Quod abſurdè dictum eſſe, per ſe liquet.*

Propoſitio Sexta, *cum ejuſdem* Scholio & Conſectario; *Item* Propoſitio Septima; *cum ejus* Corollario & Conſectariis *quatuor*; *Item* Propoſitio Octava *quæque hac nituntur*; *dependent à* prop. 5 (*ut patet,* pag. 20. lin. 4, 6, 8, 10. p. 21. l. 6. p. 22. l. 5. p. 23. l. 8, 14, 28. p. 24. l. 2. p. 25. l. 1, 14, 16. p. 26. l. 18. p. 27. l. 5, 17. p. 28. l. 4.

p. 30. l. 21, 22. *nec diffitebitur* Hobbius:) *Ergo, cum illâ ruunt.*

Propoſitio Nona (*de ſectione anguli in ratione datâ*) *eodem miſero tibicine fulcitur cum* prop. 3. *nempe, in eodem circulo* Chordas Arcubus proportionales eſſe : *Adeóque juxta cum illâ cadit.*

Propoſitionis Decimæ *Corollarium verum eſt, ſi ſumatur P in producta Db ; non autem, ſi in productâ AK. Cùm verò hæc duo P habeat* Hobbius *pro eodem, hallucinatur. Non enim coeunt AK, Db, in eodem rectæ BC puncto P ; ut poſt dicetur.*

Propoſitio Undecima *falſa eſt ; nempe* Tangentes grad. 30 & grad. $22\frac{1}{2}$ ſimul æquari Radio. *Hoc eſt (per Canonem Tangentium) in numeris abſolutis quàm proximè* $5773503+4142136=10000000$: *vel (accuratè) in ſurdis* $\frac{1}{3}\sqrt{3},+\sqrt{2}-1,=1$. *(ſatis abſurdè.) Nec probat ille (quod in demonſtratione aſſumitur,)* rectas *AK, Db,* productas incidere in *(Rectæ BC)* punctum *P. Poteſt utique punctum concurſûs (non obſtante probatione ſuâ) vel ſupra vel infra rectam BC contingere. Quod enim in probationem adducit,* pag. 37. lin. 21. Cum enim &c. *non ſequitur. Ut ut enim angulus quem faciunt (productæ) AK, Db, ſit* $\frac{7}{12}$ *unius recti ; & quem cum BC facit (producta) AK,* $\frac{8}{12}$ *; & quem cum eâdem BC facit (producta) Db,* $\frac{9}{12}$ *unius recti ; non tamen hinc magis ſequitur, punctum concurſûs rectarum AK, Db, in rectâ BC contingere, quàm in (huic parallelâ) rectâ GH. Nam hic eadem verbatim dicenda eſſent ;* Cum enim angulus *CPD (vel HRD)* ſit Novem, & angulus *(GSA)* quem facit tangens 30 graduum cum ſuâ ſecante ſit Octo, *(duodecimæ unius recti ;)* & reliquus angulus *(quem faciunt productæ AK, Db, nempe ſeptem duodecimæ)* complementum ad duos rectos ; *Ergo, quid? Num,* Ergo rectarum *AK, Db,* punctum concurſûs eſt in rectâ BC ? *Imò non minus ſequitur,* Ergo eſt in rectâ *GH. Sed hoc non ſequi, fatebitur* Hobbius. *Ergo nec illud.* Conſectarium *unà ruit cum propoſitione.*

Propoſitionis Duodecimæ *falſum eſt* Corollarium. *Non enim ſunt æquales CO &* $\frac{1}{2}AT$. *Sed (poſito Radio DA, vel DC, = R,) erit gradunm 30 Tangens* $AT=\frac{1}{3}R\sqrt{3}$ *(utpote dimidia ſecantis* $\frac{2}{3}R\sqrt{3}$, *cujus quadratum complent quadrata AD & AT,) adeóque* $\frac{1}{2}AT=\frac{1}{6}R\sqrt{3}$. *Sed* $CO=R-\frac{1}{2}R\sqrt{2}$ *(exceſſus radii DC ſupra DO ſinum grad. 45.) Non ſunt ergo CO &* $\frac{1}{2}AT$ *æquales. Sed nec ille æquales eſſe demonſtrat. Et ubi hoc aggreditur* (coroll. prop. 10.) *hallucinatur. Supponit enim (quod non probat, ut ad* prop. 11. *oſtenſum eſt) rectas AK & Db in eodem rectæ BC puncto P concurrere.*

Propoſitio Decimatertia *ſubvertit primam. Nam hîc agnoſcitur & adhibetur ſectionis rectæ in extremâ & mediâ ratione conſtructio* Euclidea ; *ubi recta ſecunda ad ſegmentum majus eſt ut* $2\ \sqrt{5}-1$, *non (ut in* Hobbianâ, prop. 1.) *ut 2 ad* $\sqrt{u:5-2\sqrt{3}}$.

Propoſitio Decimaquarta *falſa eſt. Eſt enim graduum* 30, *ſecans* $\frac{2}{3}R\sqrt{3}$; *adeoque extremâ & mediâ ratione ſectæ ſegmentum majus* $\frac{\sqrt{5}-1}{2}\times\frac{2}{3}R\sqrt{3}=\frac{\sqrt{5}-1}{3}R\sqrt{3}$. *Sed Semidiagonalis quadrati ex Radio,* $\frac{1}{2}R\sqrt{2}$. *Non ſunt igitur æquales. Ubi autem (in probatione) dicit,* Oſtenſum enim eſt prop. 10. rectam *BP* duplam eſſe rectæ *CO*: *ludit in ambiguo. Oſtenderat enim BP,* reſiduam tangentis *CP* (*grad.* $22\frac{1}{2}$) ad radium, *duplam eſſe CO* ; *ſed non BP* tangentem grad. 30. *Quas cum ille pro eâdem habet, hallucinatur* ; *ut ad* prop. 11. *oſtendimus.*

Prop. Decima quintâ, *novam commendat Geometrizandi methodum, quam (credo) ipſe ſequitur. Suaſum utique it (non probatum)* In omni quæſtione Geometricâ, multò prudentius eſſe, Mechanicè menſurando magnitudinem quæſitam quam poteſt fieri veritati proximam, & deinde cauſam inquirere propinquitatis ; quàm credens incertæ Logicæ vel Logiſticæ pronunciare. Et multo credibilius à Menſurâ pronunciare Menſorem diligentem, quàm Algebriſtam ſeu Arithmeticum. (*Non itaque mirandum eſt*, Hobbium, *his methodis utentem, talem nobis producere Geometriam ; utpote cui Circinus eſt Calculo accuratior.*) *Sed &*, Studioſum veritatis non putandum eſſe, qui ſententiam videns ſuæ contrariam, fultam veriſimilibus argumentis (*putà, circini indicio*) contentus ſit pugnare contra demonſtrationem. (*Quaſi quidem, in re exploratâ & ſæpiùs demonſtratâ, non ſufficeret impugnantis paralogiſmos detegere. Sed neque hîc deſumus ; nam ſua non modò Indemonſtrata, ſed Falſa eſſe demonſtramus.*) *Hoc eſt ; Audiendum eſſe* Hobbium, *veriſimiliter (ex circini indicio in anguſto Schemate) ſine demonſtratione pronunciantem ; quàm demonſtrativé ratiocinantes alios : Nec ſatis, eum redargutum eſſe, oſtenſis ratiocinii ſui* paralogiſmis *& demonſtrationum defectibus ; aut argumentis in contrarium ſive ex* Logicâ *ſive* Logiſticâ *petitis : Quippe hæc omnia cedere vult* Circino *& ſuis* Veriſimilibus. *Bellum equidem Geometram ! Ego, contra*, Hobbio *ſuaderem potiùs ut* Veriſimilia *ſua &* Mechanicam menſuram (*ubi ἀκρίβεια Geometrica ſpectatur) Demonſtrationi (ſive ex Arithmeticâ ſive ex Geometriâ petitæ) poſthabeat ; quò (quæ ſua vox eſt) minus irrideatur.*

Propoſitione Decimâ ſextâ, *affert* (*ſi credes*) Demonſtrationem, quæ niſi confutetur, audiendi ulteriùs non erunt arguentes à poteſtate linearum. (*Ergo nec* Hobbius, *qui, ubi poteſt, ſic arguit ; ut & aliis methodis quas alibi damnat.) Sed confutatio facilis eſt. Quod enim aſſumit* (pag. 46. lin. 29.) Manifeſtum eſt tum *Kd* tum *ba* eſſe ad *ae* ut 3 ad 1 ; *falſum eſt. Verum quidem eſt* Kd *ad* ae *ſic eſſe ; ſed non* ba. *Neque affert ille quicquam quo vel probet* Kd, ba, *invicem æquales eſſe ; vel*, ba *ad* ae *eſſe ut* 3 *ad* 1. *Sed neque verum eſt : Eſt enim* Kd *ad AD ut* $\frac{3}{4}\sqrt{5}-\frac{3}{2}$ *ad* 1 ; *ſed* ba *ad* AD *ut* $\frac{1}{12}\sqrt{5}$ *ad* 1. *Non ſunt igitur (quod ille gratis & falſò aſſumpſit) invicem æquales* Kd *&* ba. *Et propterea falſum eſt (quod porrò habet) ba* eſſe ad Hc ut 3 ad 2 ; *item*, *fa* ad *ae* ut 3 ad 2 ; *item*, junctam *cd* eſſe parallelam *ID*, *& dH*, *Hb*, invicem æquales ; *item*, *bK*, *da* æquales eſſe : (*Nam hæc omnia præſumunt*, Kd *æqualem rectæ* ba, *rectæque KH trientem eſſe :) item (quæ hinc dependent) Md* eſſe quater duo, quorum *MK* eſt ter tria ; adeoque *MK* ad *MD* ſive *MF* ut 9 ad 8. *Sed & mox, dum ait*, *MK* quintuplum poteſt *FK* ſive *Mb* ; *ſupponit (gratis quidem & falſò) FK*, *Mb*, (invicem æquales eſſe. Gratis, *inquam ; nam ne hilum quidem affert quo probet, (niſi forſan, circino rem explorans, hoc inde collegerit :) &* Falſò ; *eſt enim FK ad AD ut* $\frac{3}{4}$ *ad* 1 ; *ſed Mb ad AD* *ut* $\frac{1}{3}\sqrt{5}$ *ad* 1. *Adeoque falſum porro eſt*, ſi detrahatur FK à rectâ MK, reliquam eſſe bK. *Sed & (propter non æquales* dK, ba, *) falſum etiam eſt*, bK æqualem eſſe da. *Falſum igitur eſt quod ab his infert*, MK eſſe 9, quorum Md eſt 8, Ma 3, & da 5. *Neque hinc* Euclides, vel arguentes à poteſtate linearum, *evincuntur. Quippe illi falſum eſſe pronunciarent, nec probat* Hobbius *eſſe verum.*

Propoſitio Decima ſeptima, *dependet ex prop.* 14. (*ut liquet* pag. 49. lin. 14.) *quam falſam eſſe deprehendimus: Ergo & hæc ſimul ruit. Sed &* à confect. 3. prop. 7. *dependet*, (pag. 50. l. 15.) *quod falſum eſſe oſtendimus: Adeoque duplici ruinâ labitur. Sed & alia ſubſumit falſa; ut* (pag. 50. l. 22.) rectam Bf quintæ partis lateris AB potentiâ quintuplam eſſe; *hoc eſt,* (*poſitâ* $AC=1$) $\frac{1}{5}\sqrt{5}$; *cùm tamen ſit* $\sqrt{\frac{6-\sqrt{5}}{20}}$. *Item*, pag. 50. lin. 4. *ponit latus Icoſaedri* $\alpha\zeta$; *ſed idem facit*, $\alpha\gamma$, lin. 10, 11. *Item*, lin. 9. *vult ut ſumamus* arcus $P\theta$, $\gamma\zeta$, (*in circulis inæqualibus*) invicem æquales, (*non, ſimiles,*) *quod quomodo faciamus, nec docuit ille, nec docebit. Item*, (lin. 10.) Arcûs $P\theta$, radio BP deſcripti, radium alterum $B\theta$ (*utpote ipſi* BP *æqualem*) *probat inde* æqualem rectæ $\alpha\gamma$ (*quæ ex conſtructione eſt ipſi* BP *æqualis*, pag. 49. l. 6. 12.) *ſed mox*, (pag. 50. l. 11, 12.) *vult* eandem $B\theta$ minorem eſſe quam BP (*radium ejuſdem circuli,*) *arcúmque radio* $B\theta$ *deſcriptum*, ſecare rectam BP in e; Rectamque $B\theta$ (*non ipſi* BP, *ſed*) Be æqualem, hoc eſt, tertiæ parti rectæ Bb (*quam rectam ille perperam ſupponit æqualem arcui* AC;) & (lin. 19.) eidem Be æqualem eſſe vult rectam $\alpha\gamma$ (*quæ tamen ex conſtructione* pag. 49. lin. 12. *fuerat æqualis* BP, *cujus pars eſt* Be *ex conſtructione*, pag. 48. l. 22.) *Adeoque, nunc* $\alpha\zeta$ *nunc* $\alpha\gamma$ *ponens pro Icoſaedri latere, rectamque* $\alpha\gamma$ *ſeu* $B\theta$ *nunc æqualem nunc minorem rectâ* BP, *omnia ponit in confuſo. Poſtque hæc ita confuſa omnia, & falſis ſuffulta, ſibique invicem oppoſita;* rationem ſuam *aſſignatum it* veriſimilem, *quam* demonſtrationem *vocat* (*ineptam ſatis,*) *ſed quam rectè conjicit* Algebriſtas damnaturos, *ſed &* alios, (*quippe qui* veriſimilitudinem *ullam inibi deprehendunt;*) *Quâ quidem, ſi demonſtrandi vim haberet ullam, probaretur, non,* (*quod erat ab initio propoſitum,*) rectam $\alpha\zeta$ latus Icoſaedri, (*ut* pag. 50. l. 3, 5;) *ſed,* (*quò jam per oſcitantiam delapſus eſt,*) rectam $\alpha\gamma$ latus Icoſaedri (*ut* lin. 9, 10.) æqualem eſſe tertiæ parti (*arcûs*) ſemicirculi: (*Adeo illi indifferens eſt, ſive* $\alpha\zeta$, *ſive* $\alpha\gamma$, *ſit latus Icoſaedri.*) *Adeoque* ſubvertit *illud quod* probandum *ſuſceperat. Quâ tamen oſcitantiâ non obſtante, malè habet quòd pro legitimâ demonſtratione non ſimus habituri.*

Propoſitio Decima octava, (*de Circuli quadratura,*) *eſt Crambe (non bis tantum, ſed ſæpiùs recocta; atque hæc eadem conſtructio jam tertiò ſaltem in caſſum introducta. In demonſtratione (pro ut jam tertio tentata prodit,) illud* (pag 54. lin. 17, 18.) Quare reliquus DYP duplus eſt, tum Trilinei CYP, (*non; ſed, ſectoris* Dbi,) tum quadrilinei $VPbi$; *nullam habet vel ſpeciem conſequentiæ. Dum enim, pro* Sectore Dbi, (*quod dicendum erat,*) *ſubſtituit* Trilineum CYP, *quaſi hæc eſſent æqualia; præſumit id quod erat probandum. Quæ hinc dependet* Duplicatio Cubi, *nihilo* *itaque firmior eſt : Quam ut defendat, admittit (tanquam non incommodum)* 10. decimas ſextas, & 16 viceſimas quintas, æquales eſſe ; (pag. 55. l. 10, 13.) *ponitque*, pag 56. l. 2. *(ut ſuis effatis conſonum)* non modò 50, 40, 32, ſed etiam 50, 40, $31\frac{1}{4}$, continuè proportionales. *Quæ pueris ridenda relinquo.*

Propoſitio Decima nona, *dependet à* prop. 5. (*ut liquet* pag. 58. lin. 8.) *quam falſam deprehendimus. Item falſum illud* (pag. 58. lin. 12.) circulum centro *l*, radio *lF* deſcriptum, tranſiturum per *G* ſimul & *C (Tranſibit quidem per C, propter biſectam FC in* l ; *ſed non per G.) Probatio ejus* (pag. 58. l. 20.) *dependet à* prop. 6 *&* 7, *quas falſas deprehendimus. Deinde*, pag. 59. l. 4. *præſumit, rectas AH & DE productas, ad F (punctum in CB productâ aſſignatum) pertingere. Quorum neutrum probatum eſt ; imò ne affirmatum, ſed tacitè præſumptum ; idque falſò. Adeoque & falſa quæ ſequuntur.*

Propoſitio Viceſima *falſa eſt ; utpote quæ* (pag. 61. l. 22.) *dependet à* prop. 18. *quam falſam eſſe oſtendimus. Sed, ut ut hoc in fundamento vitium non eſſet ; quæ ſequitur* (pag. 62. l. 1, 2, 3, 4.) *eſt lepida deſignatio Centri gravitatis: unde, qui res has intelligit, facilè perſpiciet, quàm* Hobbius *eas non intelligit.* Conſectarium *(utpote inde dependens) eſt ejuſdem commatis : Sed & alio nomine vitioſum, eò quòd dependeat etiam à* prop. 5, *quæ itidem eſt falſa.*

Propoſitio Viceſima prima (*quæ &* Ultima) *item falſa eſt. In Probatione ; illud,* (pag. 63. l. 14.) Gnomon *YBM* eſt quinta pars quadrati *DYQM* ; *falſum eſt. (Nam differentia duorum quadratorum quæ ſunt inter ſe ut 5 ad 4, eſt quadrati Minoris pars* Quarta, *non quinta ; Quinta verò, Majoris.) Sed, demus hoc : Falſum quod ſequitur,* id eſt, pars quinta quadrantis *DAC : Dependet enim à* prop. 18. *(quam falſam oſtendimus) ubi putat ſe probaſſe,* Quadrati *DYQM* & Quadrantis *DAC* æqualitatem. *Item, illud,* Quare etiam Trilineum *ABCLA* eſt quinta pars quadrati *ABCD* ; *eſt pluribus nominibus Falſum. Nam, primò dicendum erat ad mentem ſuam,* quadrati *DYQM, non quadrati ABCD : (quippe* $\frac{1}{5}$ *quadrantis DAC, ab eo ponitur æqualis* $\frac{1}{5}$ *DYQM, non* $\frac{1}{5}$ *ABCD.) Sed neque de DYQM verum eſt : præſumit enim* (ex prop. 18.) Trilinea *CYP, PQL,* eſſe inter ſe æqualia ; *quod falſum eſt. Sed &, Qualis eſt ea conſequentia ; Quoniam Gnomon eſt Quinta pars quadrati Minoris ; Ergo Trilineum (quod gnomoni præſumitur æquale) eſt Quinta pars Majoris? Sed tales ejus eſſe ſolent conſequentiæ. Quòd autem inter duo quadrata DYQM, ABCD, ſubſultim ludat, (nunc de hoc, nunc de illo, idem affirmans,) pro ſolitâ ſuâ oſcitantia factum eſt. Cæteraque quæ ſequuntur, tanquam ab his pendentia, falſa ſunt.*

Adeoque percurrimus olens Roſetum, *brevibus ſtricturis Mendas ex innumeris multa notantes : Alia quamplurima conſultò prætereuntes, ut vel minoris momenti, vel quæ opus non erat ad ſubvertendas propoſitiones. Sed talis expectanda erat Geometria ab eo, qui, magnitudines circino dimenſus,* *quas ita non deprehendit inæquales, pro æqualibus tuendas exiſtimat, etiam indemonſtratas, & contra demonſtrationum authoritatem; quam ille circino poſtponit. Gloriatum tamen audio (ſic ſua deperire ſolet,)* ex omnibus ab eo editis, hunc librum eſſe optimum.

Quæ autem de me habet, ſive ad libri Calcem ſive ad Frontem, contemnenda ſunt. Quippe, præter pueriles quaſdam circa voces ineptias (quas in perverſum ſenſum fruſtra conatur detorquere,) cætera fere huc tendunt. Se Symbola *non intelligere;* Arithmeticam ſpecioſam, *&* Logiſticam *ſibi non placere; ſed nec,* Geometriam Indiviſibilium; *aut,* Arithmeticam Infinitorum. *(Et quidem mihi perinde eſt, ſive ſic, ſive ſecus. Nam jamdiu eſt quod* Hobbij *authoritas in Mathematicis ne hilum valuerit, ejuſque ratiocinium, tantundem.) Sunt autem ea omnia tam crudè, inſulſè, pueriliter ab eo dicta; ut, quicunque rerum harum intelligens, ad loca notata reſpiciat, pro me facilè, etiam non monitus, ſit reſponſurus.*

Tuus Johannes Wallis.

The *Short* of this Anſwer, dated *June* 27. 1671. (which is ſtill with the Publiſher) was intended to have been inſerted in the former Tract of *June*; but ſince it could not then be conveniently done for want of room, the Anſwerer thought fit, ſomewhat to enlarge it for this opportunity.

An Accompt of ſome Books.

I. *De MOTIONIBVS A GRAVITATE DEPENDENTIBVS Liber* Joh. Alphonſi Borelli, *In Academ. Piſana Matheſeos Profeſſoris:* Regio Julio, 1670. *in* 4°.

THe Learned Author of this Book maintains therein, *That* all Bodies Sublunary have Gravity: *that* they exerciſe this in endeavors to approach towards the Center of the Earth: *that* the ſuperior Body or the ſuperior parts of the ſame, Solid or Fluid, do gravitate on the inferior, when at reſt: *that* there is no *Poſitive* Levity in nature: *that* Lighter bodies aſcend, becauſe thruſt out of their place by Heavier: *that* the Air is heavy, Elaſtick or Springy, and doth thereby perform thoſe things that were wont to be aſcribed to *Fuga Vacui*; *that* the ſame is capable of very great Expanſion and Contraction: that there is not in nature any proper Attraction or Suction; but things ſeeming ſo to be perform'd are done by the Pulſion or Truſion of other Bodies: *that* there is a Neceſſity and a great Uſe of *Vacuities* in nature, notwithſtanding the ſubtile and all-pervading Matter of *Des-Cartes*; with many other things conſonant hereto. For theſe Aſſertions he brings Arguments; anſwers Objections and Difficulties, and particularly thoſe that are alledged to aſſert a *Vacuum*: And from thence ſolveth a great many *Phænomena* in Nature; as, *about* the *Torricellian* Experiment and others thereunto appertaining; *about* Siphons, Pumps, Syringes, Cupping-glaſſes, &c. *about* the Nature of Fluidity; (where he examins and animadverts upon the *Carteſian* doctrine concerning the ſame:) the Aſcent of water above its Level (in ſmall Pipes and otherwiſe;) and its contracting it ſelf into Globular drops: *of* its Expanſion in Freezing, and its Strength thereupon: *of* the Degrees of Velocity in lighter Bodies aſcending in Water; and of Water running out of Tubes or other Veſſels perforated at the bottom: *of* Fermentations; and Diſſolving Salts, Mettals, &c. in liquid Menſtruum's: with many more, too numerous to repeat here.

II. Diſſertationes duæ Medicæ *de VENENO PESTILENTI: Studio* Caroli de la Font, *M. D. & in Acad. Avenion. Prof. primar. Amſtelodami, in* 12°.

IN the former of theſe two Diſſertations the Author treateth of the Nature and Cauſes of the *Plague*, without any recourſe to Occult Qualities, or the Influence of the Stars; deducing the Peſtilential Venom from the Air infected and corrupted *chiefly* by Arſenical

Exhalations, either breathed in at the Mouth or Noſe, and ſo affecting the Lungs and Brain, or piercing through the Skin into the other parts of the Body, and there working, not by *Coagulation* (as Dr. *Willis* would have it, on whom the Author animadverts, though very civilly,) but by *Corroſion*, which, in his opinion, depends not from Heat or any other of the four Firſt Qualities, celebrated in the Schools, but from a certain Conformation of Salin corroſive particles, manifeſt in *Arſenick* by many effects, here ſpecified, and particularly thoſe, that have been obſerved in the Bodies of ſuch as dyed of the Plague, in which not only the interior membrane of the Stomach, but alſo all the Bowels have been found corroded, black, ſphacelated and corrupted. Yet he denieth not, but that with this *Arſenical* venom ſome other, and eſpecially *Mercurial*, Vapors may concur, which being joyned and ſublimed together with other Volatil particles become highly deſtructive, being taken into ſuch Bodies, as were prediſpoſed, before others, to receive them by their depraved conſtitution, or by a too great fulneſs of bloud, or obſtructions, or perturbations of humors cauſed from fancy, fear and conſternation, &c.

As for the Spreadingneſs of the Plague, he eſteems, and endeavors to evince, that it is not ſo Contagious as is commonly believed, but that, (whereas there are ten perhaps that get it by infection from others, there are thouſands that are ſtruck with it from the Air, harbouring the ſeeds of it in a peſtilential conſtitution.

In the *other* Diſſertation the Author delivers the ſeveral Means of Curing the Plague; either by expelling, or diſperſing, or intangling, or rebating, or fixing, or impeding the penetration of thoſe Corroſive particles, that invade the Body; where he mentions the ſeveral remedies, by him judged proper in the ſaid reſpective methods: Concluding with a diſcourſe about the beſt wayes of Preſervation from the Plague; of which he preſcribeth principally theſe three, either by Retiring a far off, or by Correcting, or by Fortifying our ſelves againſt the Peſtilential Air; adding his thoughts, how the two latter wayes may be beſt performed.

III. *Tractatus de CORDE, item de MOTU & COLORE SANGUINIS, & Chyli in eum tranſitu: Cui acceſſit Diſſertatio de Origine CATHARRI. Auth.* Richardo Lower, *M. D. Editio tertia & noviſſima.* Amſtelodami 1671. *in* 8°.

HAving already given an Accompt of the principal part of this Treatiſe in *Numb.* 45. of theſe Tracts when it was printed the firſt time; we ſhall here only add ſomething about the newly annexed Diſſertitaon of the *Origin* and *Cure* of *Rheumes*. As to their *Origin*, the Learned Author, having declared, with the generality of Phyſitians, that Rheumes are bred from the Serous part of the Bloud, ſever'd from it by an impeded Tranſpiration, he undertaketh to evince the erroneouſneſs of the Vulgar opinion, deriving all ſorts of Defluxions from the Brain, by ſhewing, that, whereas the Authors and Teachers of that Tenet do acknowledge, that the Water collected in the Ventricles of the Brain deſtilleth only through the *Os Cribri-forme* into the Noſe, and through the *Glandula pituitaria* into the Palat; the Structure of thoſe parts is ſuch, that that can be done neither of theſe wayes; which aſſertion of his is accompanied with divers conſiderable Obſervations and Experiments; as alſo with an Anſwer to thoſe, that apprehend great danger to the Brain from the excrementitious matter gathered therein, if it ſhould not be purged out from thence by the Eyes, Noſtrils, Ears and the Palat. Which being diſpatched, he proceeds to ſuggeſt the wayes of ſtopping and curing Defluxions, by obſerving, that, ſince the Matter for Rheumes is furniſhed by the *Serum* of the Bloud, whatever is able to withdraw that *pabulum*, or to precipitate the ſeroſity through the Kidneys, or to convey it away by ſiege, or to diſpell it through the pores of the Body, is ſufficient to perform the cure.

IV. Franciſci de le Boe Sylvii *M. D. & Prof. Oratio de* AFFECTVS EPIDEMII, *A.* 1669. Leidam *depopulantis*, CAVSIS NATVRALIBVS. Lugduni Batavorum, 1670. *in* 12°.

THis Learned Diſcourſe, together with the Firſt part of the *Praxis Medicæ Idea Nova*, was lately in ſeveral Copies preſented from the Worthy Author, both to *his Majeſty*, and to the *Royal Society*, and particularly to the Noble Preſident and divers Eminent Members of the ſame for their Examination. And as we gave very lately a freſh Accompt (in *Numb.* 71.) of the ſaid *Firſt part* now perfect, after we had taken ſome notice of it formerly, (in *Numb.* 40.) when it was yet incompleatly printed; ſo we cannot omit to give here a Breviat of this ingenious Oration.

In it the Author declareth and endeavors to prove, that the late waſting Diſeaſe in the City of *Leiden* is to be imputed to theſe concurrent ſecond Cauſes, *viz.* The Exceſſive Heat, long continued Calms, want of Rain, and the Vapors of Standing and Muddy waters abounding in that place, together with certain Salin and noxious Exhalations of the Earth, by the force of the Sun propelled into the Air, and there mingled with the former. From which, being well conſider'd, he eſteems, that all the various and even the moſt different and grievous Symptoms, that were obſerved in the ſick people at *Leiden* may be rationally derived; adding thereunto his Opinion of the Cauſe, why Rich and Delicate perſons were firſt of all and ſooner attacked and deſtroyed by that Diſeaſe, then thoſe of the Poorer and Hardier ſort of people; though theſe latter fell in greater numbers about the end of this Sickneſs, than the former.

In the diſcourſe about the ill effects of a tainted Air upon Human Bodies, he taketh occaſion to inſinuate, That as 'tis difficult to prove, ſo 'tis hard to deny, that ſome part of the inſpired Air is alſo commixed with the *Saliva*, and being together with other Humors, falling from the Brain and its Glanduls and the glandulous Tunicles, derived to the Mouth and Throat, and ſo ſwallow'd together with the ſame, cauſeth in the Stomach and ſmall Guts ſome alterations in the humors there found or meeting together. But as he thinks this not improbable, ſo he judgeth, that there are yet required many accurate Obſervations to clear up and eſtabliſh ſo obſcure a Doctrine.

V. *HYPOTHESIS PHYSICA nova, ſive THEORIA MOTVS CONCRETI, una cum THEORIA MOTVS ABSTRACTI. Auth.* Gothofredo Guilielmo Leibnitio, *J. V. D. & Conſiliario Moguntino.* Londini *Impenſis* Joh. Martyn, *R. Societatis Typographi, ad inſigne Campanæ in Cœmeterio D. Pauli*, 1671. *in* 12°.

THe Ingenious Author of this ſmall Tract, though by profeſſion a Civilian, and one of the Privy Counſel of his Electoral Highneſs of *Maintz*, and upon that Accompt very much taken up with publick affairs, is yet ſo much pleaſed with the ſtudy and ſearch of Nature, that whatever hours he can redeem from his State-employment, he ſpends in that which he judgeth incumbent upon him as Man, I mean the Contemplation of the works of God and Improvement of Natural Philoſophy. What he hath therein performed, he imparts in this *Hypotheſis* to the Learned world, and dedicateth it to the *Royal Society* of *England*, and the *Royal Academy* of *France*, deſirous in his Letters to have their thoughts concerning the ſame; wherein he maketh it his buſineſs to ſhew, that by the help of it the Cauſes of moſt of the *phænomena* of Nature may be rendred from one ſingle and univerſal Motion, ſuppos'd in our Globe, neither croſſing the *Copernican* nor *Tychonian* Hypotheſis; the Author having ſo managed the whole, as that all Sects may bear and admit what he here produceth, without a prejudice to their own Opinions.

A Copy of this Tract being Communicated, beſides others, to the Excellent Dr. *Wallis*, Fellow of the *R. Society*, and *Savilian* Profeſſor of Geometry in the Univerſity of *Oxford*, with a deſire to examine the ſame, and to give his judgment thereof, he was pleaſed to make a return in Latin, which for want of room here, we muſt refer to another opportunity.

VI. *PHILOSOPHVS AVTODIDACTVS, exhibitus in Epiſtola, ex Arabica in Latinam Linguam verſa ab* Edvardo Pocokio, Oxonii 1671. *in* 4°.

THis Book being tranſlated out of a fair *Arabick* Manuſcript in the *Bodleian* Library into *Latine* by the care of the Learned Dr. *Pocock*, and printed in both the Languages together, is a very ingenious piece, and, by the teſtimony of the skilful, elegant in the Original, and an excellent ſtyle. The deſign is to ſhew, How from the Contemplation of things here below, Man by the right uſe of his Reaſon may raiſe himſelf unto the knowledge of higher things; which is here perform'd by a *Faigned Hiſtory* of an Infant expoſed, he knows not how, on an Iſland not inhabited; where he was nurſed up by a *Gazel* (or kind of wild Dear) and coming afterwards to years of knowledge, did by his ſingle Uſe of Reaſon and Experience (without any human converſe) attain the underſtanding, firſt of Common things, the neceſſaries of human life; how to ſhift among the Beaſts for his food, &c; the uſe of cloaths, of weapons (to keep the beaſts in order, who were before too hard for him;) then to the knowledge of Natural things, of Moral, of Divine, &c. And afterwards by an accident coming to know that there were other men in the world beſide himſelf, and being removed out of his Iſland to them, and having learned the Language, was found to excell their ſtudied Philoſophers.

The whole deſign handſomely laid, and ingeniouſly proſecuted. The Epiſtle written by *Abi Jaafar*, contemporaneous to *Averroes*, who lived about 500 years ago; at which time, it ſeems, it was already known, that the Countries in the *Torrid Zone* were habitable, as appears by the Preface of Dr. *Pocock* to the Reader.

ERRATA.

N°.68. p.2064. l.36. r. *Cichory-flowers, but alſo Lark-ſpur, Borage.* N°.70. p.2134. l.7. r. *Muſcus* for *Fungus*.
In this *Numb.* 73. p.2193. l.5. r. *as compreſt the Air.*

LONDON,

Printed for John Martyn, *Printer to the Royal-Rociety.* 1671.

PHILOSOPHICAL TRANSACTIONS.

Auguſt 14. 1671.

The CONTENTS.

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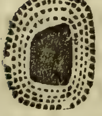
An Intimation of divers Philoſophical particulars, now undertaken and conſider'd by ſeveral Ingenious and Learned men; here inſerted to excite others to joyn with them in the ſame or the like Attempts and Obſervations.

First, we have notice given us, that at *Paris* the Excellent Signior *Caſſini* hath lately detected again *Spots* in the Sun, of which none have been ſeen theſe many years, that we know of. 'Tis hoped that that learned Aſtronomer will ſhortly publiſh a Deſcription of what he ſhall have obſerved of this kind. Mean time we cannot but acquaint the Curious, that, as far as we can learn, the laſt obſervation in *England* of any *Solar Spots*, was made by our Noble Philoſopher Mr. *Boyl*, vvho, upon an occaſional diſcourſe of this Subject, vvas pleaſed to communicate vvhat he had obſerved of this kind, as he found it regiſtred in his *Notes*, viz.

Friday, April 27. 1660. *about 8 of the clock in the Morning, there appear'd a Spot in the lower limb of the Sun a little towards the South of its* Æquator, *which was entred about* $\frac{1}{40}$ *of the Diameter of the Sun, it ſelf being about* $\frac{1}{160}$, *in its ſhorteſt Diameter, of that of the Sun; its longeſt, about* $\frac{1}{40}$ *of the ſame. It diſappear'd upon Wedneſday Morning (May 9th) though we ſaw it the day before about* 10 *in the morning to be near about the ſame diſtance from the Weſt-ward limb a little South of its* æquator, *that it firſt appear'd to be from the Eaſt-ward-limb, a little South alſo of its* æquator, *It ſeem'd to move faſter in the middle of the Sun than towards the limb. It was a very dark Spot almoſt of a quadrangular form, and was encloſed round with a kind of duskiſh cloud, much in this form and in this proportion to the Spot.*



We firſt obſerv'd this very ſame Spot both for figure, colour and bulk, to be re-enter'd the Sun May 25th, when it ſeem'd to be in a part of the ſame line it had formerly traced; and was enter'd about $\frac{4}{33}$ *of its Diameter about 7 of the clock in the afternoon. At the ſame time there appear'd another Spot, which was juſt entred and appear'd to be entred not above* $\frac{1}{132}$ *part of the Sun's diameter. It appear'd to be longeſt towards the North and South, and ſhorteſt towards the Eaſt and Weſt. There ſeem'd to be diſpers'd about it divers ſmall clouds here and there.*

Theſe Obſervations vvere made, as the Noble Obſerver told us, vvith an excellent Teleſcope, in the preſence of divers Curious and Ingenious perſons, one of vvhom was Mr. *Hook*. And diſcourſing of the thoughts he had entertain'd touching the Effects of ſuch Spots, he ſuggeſted this Inquiry, Whether they might not cauſe a conſiderable alteration both in the Body of the Sun it ſelf, and in our Air and the Bodies in it upon their diſſipation?

Secondly, vve underſtand, that at *Paris* the *Royal Obſervatory*, now a building for making Celeſtial Diſcoveries, is very far advanced, and will ſhortly be in a condition to be employed for the uſe intended; whence vve may expect a conſiderable advancement of the Aſtronomical Science. In the ſame Edifice, vvhich the ſaid *Obſervatory* maketh a part of, we are inform'd that there is, beſides many other rooms fit for Philoſophical uſes and purpoſes, a very deep Cave, having an hundred threeſcore and ten ſteps of deſcent; wherein many ſorts of Experiments are intended to be made, being of that nature, that they require to be remote from the Sun-beams and the open Air; ſuch as are Thermometrical ones, and ſuch as concern Refrigerations, Coagulations, Indurations, and Conſervations of Bodies, and a thouſand things more.

Thirdly, vve hear, that the Learned Monſieur *Mariotte* is publiſhing two very deſirable Diſcourſes, the one of *Viſion*; upon vvhich ſubject he hath diſcovered ſomething new and conſiderable: the *other* of the Art of *Levelling*, vvherein he delivers many remarkable particulars about Refraction, and the Errors, that may, upon the account thereof, be impoſed upon men ; together with ſeveral New Inſtruments of Levelling exactly.

Fourthly, vve find by Letters out of *Germany*, that the learn'd Phyſitian Dr. *Kornmannus*, is printing a Book concerning the Tinctures or Eſſences of the Excretions of Inſects, which having fed upon ſeveral herbs and flowers, yield ſuch dungs, vvherein the tincture, colour and vertue of theſe vegetables are to be found: Thus for example, he can extract a curiouſly red tincture out of Excrements of Worms that have fed upon Roſes, *&c.*

Fifthly, vve find by Letters out of *Italy*, that a very Ingenious perſon there, upon the conſideration of what hath been lately intimated touching certain Experiments for finding out, whether there be a Circulation of Sap in Trees, reſembling that of Bloud in Animals ; Offers it to the conſideration of Naturaliſts, Whether it be likely to find a place in Vegetables, whence the Sap may part, and whither it may return, ſuch as is the Heart in Animals ; adding, that whereas Vegetables are alwayes to put forth new branches, leaves, *&c.* it ſeems to be ſufficient for them, that there be a continual and plentiful courſe and ſupply of Juyce, to thruſt out every way, without any neceſſity of ſuch a Circulation.

Sixthly, whereas it hath been more than once mention'd in theſe Papers; * *Mulierum teſtes eſſe Ovario analogos ; nec tantùm in nuptis & fæcundis Mulieribus, ſed etiam in Virginibus eſſe Ova vera*, &c. We cannot but ſignifie here, for further inquiry, that there hath been very lately made by two Phyſitians at *Paris* a diſſection of a Cow, *in cujus teſticulis ova reperta fuerint, uti Kerkringius obſervaſſe ſe ſcripſerat in Anthropogeniæ ſuæ Ichnographia* ; and that *there* they intend to purſue this Inquiry, inviting others to make the ſame reſearch. Wherein ſince the learned Dr. *Walter Needham*, an Engliſh Phyſitian, and a worthy Fellow of the *R. Society*, hath heretofore already been converſant to good purpoſe, it is here publikely wiſhed, that he would make a further progreſs in the ſame ; *plures*

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* See *Numb.* 32. p. 628, and *Numb.* 70. p. 2136.

inſtituendo diſſectiones, catellarum imprimis valdè juvenum, &c. *ad rei certitudinem majorem.*

Seaventhly, from *Germany* we are inform'd, that in the Univerſity of *Jena* in *Upper Saxony*, one Mr. *Weighelius*, Profeſſor of the Mathematicks there, hath invented ſeveral ingenious Inſtruments and Engins; As firſt, an Aſtronomical one, which he calls *Aſtrodicticum*, by the means whereof very many perſons ſhall be able at one and the ſame time to behold one and the ſame Star. Secondly, An exceeding great *Globe* of the *World*, capable of ten perſons to ſit in it all at once, and to behold the motions of the celeſtial Bodies, *&c.* Thirdly, An *odd Bridge*, or a kind of Stairs, by which a man ſhall deſcend and yet really be raiſed upward, and going as 'twere upon a plain ſhall, from a lower, by gently ſubſiding, arrive to an upper ſtory, *&c.* Of theſe and other particulars, ſaid to be in part already done, and in part deſign'd by the ſaid Mathematician, we hope we ſhall in time obtain a more ſatisfactory accompt.

The Extract of a Letter written by Mr. John Ray *to the Publiſher from* Midleton, *July* 3. 1671. *concerning Spontaneous Generation; As alſo ſome Inſects ſmelling of Musk.*

Sir,

As to the particulars contain'd in your Letter, I well remember, that Mr. *Liſter* did, a good while ſince, write me his opinion concerning *Vegetable Excreſcencies*, and the Inſects therein bred and harboured; but the Letter containing that Diſcourſe I have not at preſent by me, it being ſent away in a bundle of other Letters and papers into *Eſſex*. I have therefore written to him to deſire him, to take the pains himſelf to ſend you his thoughts upon that ſubject. *

* *The Reader is like to find this Accompt in the Tranſactions of the next Month.*

Whether there be any *Spontaneous* or Anomalous *Generation* of Animals, as hath been the conſtant opinion of Naturaliſts heretofore, I think there is good reaſon to queſtion. It ſeems to me at preſent moſt probable, that there is no ſuch thing ; but that even all Inſects are the natural iſſue of parents of the ſame *ſpecies* with themſelves. *F. Redi* hath gone a good way in proving this, having cleared the point concerning generation *ex materia putrida*.* But ſtill there remain two great difficulties. The *firſt* is, to give an accompt of the production of Inſects bred in the By-fruits and Excreſcencies of Vegetables, which the ſaid *Redi* doubts not to aſcribe to the Vegetative Soul of the Plant that yields thoſe Excreſcencies. But for this I refer you to Mr. *Liſter*. The *ſecond*, to render an accompt of Inſects bred in the Bodies of other animals. I hope ſhortly to be able to give you an accompt of the Generation of ſome of thoſe Inſects, which have been thought to be *ſpontaneous*, and vvhich ſeem as unlikely as any to be after the Ordinary and Uſual vvay.

* Of this Author an Accompt was given in *Numb.* 66. p. 2436.

Of ſuch an Inſect, as you mention, feeding upon *Ranunculus*, vvhich vvhen dried yields a Musky ſcent, I have no knowledge. I can at preſent call to mind but two ſorts of Inſects that I have ſeen, which ſmel of Musk. The *one* is like the common *Capricornus* or *Goat-chafer*, which is mention'd by all Naturaliſts that vvrite of Inſects, and vvhich ſmels ſo ſtrong of that perfume, that you may ſcent it at a good diſtance as it flies by, or ſits near you. The *other* is a ſmall ſort of *Bee*, vvhich in the South and Eaſt-parts of *England* is frequently to be met withal in Gardens among flowers in Spring-time. I remember, they vvere very plentiful in Sir *Edw. Duke*'s *Tulip-Garden*, vvhen the Tulips flowred. Sir *Edward* is now dead ; his houſe was not far from *Saxmundham* in *Suffolk* ; the name of the Pariſh I have forgot.

I have by me the Deſcription and Anatomy of a *Porpeſs* (vvhich fiſh I happily met vvithal at *Weſt Cheſter*) in vvhich there are ſome particulars, that I find not in the Deſcriptions of *Rondeletius* or others, which, if you pleaſe, I ſhall ſend you *. I reſt, *&c.*

* When this ſhall come to hand, we intend to communicate it to the Curious, the ingenious Author permitting it.

An

Another Extract of a Letter written from Midleton *in* Warwickſhire *to the Publiſher July* 10th. *by* Francis Willughby *Eſquire; about the Hatching of a kind of Bee, lodged in Old Willows.*

THe Cartrages that I got at *Aſtrop** near a Twelfmonth ago, do now almoſt every day afford me a *Bee*; and I can hear them gnawing out their way before I ſee them: So that there is nothing irregular in the way of breeding of theſe Bees; But the contrivance of God and Nature in it is very admirable. Having ſhut their yong ones in thoſe Cels with ſufficient proviſion, they all, as well the uppermoſt as lowermoſt, before Winter come to their full growth, or are turn'd into *Nympha*'s; in vvhich condition they are deſigned to lye all Winter, as the moſt of Inſects do. The next Summer thoſe muſt neceſſarily be firſt excited out of their *torpor*, and changed into flyers by the external heat and ayr, that lye next it. If any be laid ſo late, that they have not time enough to come to the ſtate of *Nympha*'s before Winter, they vvill moſt certainly dye; and then it is no loſs nor inconvenience, though their Cells be perforated.

* See two Letters concerning this matter, in *Numb.* 65. of theſe Tranſactions.

The *Scolopendra*, ſpoken of by the *German* Philoſophers in *Numb.* 68. *p.* 2082. §. 31. of the *Tranſactions*, is that which is our *Bruchus*, deſcribed by *Muffet*, in the latter part of his Chapter *de Julis*, *p.* 202. I ſaw it in the Cloiſters of *Trinity* Colledge in *Cambridge*, 12 or 13 years ago. It ſhall go hard, but I will ſend you ſome ſhortly. I am, *&c.*

A further Accompt of the Stellar Fiſh; *formerly deſcribed in* Numb. 57. *p.* 1153; *with the Addition of ſome other Curioſities.*

THis Accompt was communicated by the ſame Gentleman, that imparted the former, in a Letter written from *Boſton* in *New England Oct.* 26. 1670. as followeth;

—— Since my former, I found out the Fiſher man, who brought that *Stellar Fiſh* from Sea. I asked all the queſtions I could think needful concerning it. I underſtood from him, that he never ſaw nor heard of any but thoſe few, that were taken by himſelf, which were not above ſix or ſeven in all, and thoſe at ſeveral times, not far from the Shoals of *Nantucket* (which is an Iſland upon the Coaſt of *New England*,) when he was fiſhing for Cod, and ſuch like Marchantable fiſh. This *Stellar Fiſh*, when it was alive, and firſt pull'd out of the water, vvas like a basket, and had gathered it ſelf round like a Wicker-basket, having taken faſt hold upon that bait on the hook, which he had ſunk down to the bottom to catch other Fiſh, and having held *that* within the ſurrounding *brachia*, would not let it go, though drawn up into the Veſſel; until by lying a while on the Deck, it felt the want of its natural Element, and then voluntarily it extended it ſelf into the flat round form, in which it appear'd when preſented to your view.

What motion theſe fiſhes had in the water, could not be known to him, for the water was deep, & they could not be ſeen in any other form than ſo gather'd up together to hold faſt the bait. The only uſe that could be diſcern'd of all that curious compoſure wherewith Nature had adorned it, ſeems to be, to make it as a purſenet to catch ſome other fiſh or any other thing fit for its food, and as a basket of ſtore to keep ſome of it for future ſupply, or as a receptacle to preſerve and defend the young ones of the ſame kind from fiſh of prey; if not to feed on them alſo (which appears probable the one or the other;) for that ſometimes there were found pieces of Mackerel within that concave: And he told me, that once he caught one, which had within the hollow of its embracements a very ſmall fiſh of the ſame kind, together with ſome piece or pieces of an other fiſh, which was judged to be of a Mackerel. And that ſmall one ('tis like) was kept either for its preſervation or for food to the greater; but being alive, it ſeems moſt likely it was there lodged for ſafety, except it were accidentally drawn within the net, together with that piece of fiſh, upon which it might be then feeding.

He told me further, that every one of thoſe ſmalleſt parts * had motion when it was alive, and a tenacious ſtrength; but after it was dead and extended to a flat round, it was ſo britle that it could not be handled without breaking ſome parts of it; but by careful laying of it to dry, it was thereby ſomewhat hardened.

* See the Figure of this Fiſh in *Numb.* 57.

He added, that he had taken one of this kind of fiſh the latter end of this Summer, but had left it with a friend at another port where he had been. Mean time he promiſed to procure it for me when he ſhould ſail thither again, if it vvere not then broken or defaced. I hope I ſhall engage him for the future to take better notice of what may be remarkable about it. Upon occaſion I have inquired of divers other Fiſhermen and Mariners, but can meet with none other that ever have taken any of theſe fiſhes. This Fiſherman could not tell me of any name it hath, and 'tis in all likelihood yet nameleſs, being not commonly known as other Fiſh are. But, until a fitter *Engliſh* name be found for it, why may it not be called (in regard of what hath been before mentioned of it) a *Basket-Fiſh*, or a *Net Fiſh*, or a *Purſ-net-Fiſh*?

I ſend you withal a litle Box, with a Curioſity in it, which perhaps will be counted a trifle, yet 'tis rarely to be met with even here. It is the curiouſly contrived Neſt of a *Humming-Bird* *, ſo called from the humming noiſe it maketh whil'ſt it flies. 'Tis an exceeding litle Bird, and only ſeen in Summer, and moſtly in Gardens, flying from flower to flower, ſucking Hony out of the flowers as a Bee doth; as it flieth not lighting on the flower, but hovering over it, ſucking with its long Bill a ſweet ſubſtance. There are in the ſame Neſt two of that Birds Eggs *? Whether they uſe to have more at once, I know not. I never ſaw but one of thoſe Neſts before; and that was

* Of which ſee a notable Deſcription in the Hiſtory of the *Antiles l.1.c.15.art.17.* where it hath the name of *Colibry.*

* Theſe Eggs were ſo ſmall, that being weighed by the Publiſher, the one weighed but about 5 grains, the other 3½: And the whole Neſt weighed no more then 24 grains.

was ſent over formerly, with ſome other Rarities, but the Veſſel miſcarrying you received them not.

An Extract out of the 3d *and* 7th Venetian Giornale de Letterati, *concerning the* Formation *of* Fætus's.

THe Author of theſe Journals, propoſeth in the *third* of them this Inquiry, *viz.*

Wherein conſiſts the *cauſa formatrix* of the *Fœtus*; whether in the native Heat, as the Ancients taught; or in Motion, as the Moderns are inclined to believe: And if the latter, whence that motion proceeds, and here it is diverſified for the conſervation of various ſpecies's?

The Journaliſt having been informed, that Signor *Gieronymo Barbato*, publick Profeſſour of Practical Phyſick at *Padua*, and Phyſitian in *Venice*, had written a Book upon that ſubject, and illuſtrated it with new Anatomical Diagrams, all ready for the Preſs; did, it ſeems, obtain the peruſal of the Original Manuſcript, and permiſſion withal, to make an Extract thereof, which in this Journal he preſents the Curious with, to ſtay their deſire whil'ſt the whole Diſſertation is printing. This Breviate we thought fit to *Engliſh* here out of the *Italian*, as followeth;

The Author, Signor *Gieron. Barbato*, firſt delivers the chief Sentiments of the Ancients and Moderns concerning the *Formative Soul*; ſhewing that from variety of thoſe Opinions there reſults nothing but darkneſs. He alſo mentions ſome others touching the uſe of the *Teſticles*, whom he modeſtly refuteth, animadverting upon ſome Errors both of old and new Anatomiſts. Then he diſcourſeth of ſome principal parts conſtituting the ſame, which he thinks have not been rightly obſerved hitherto: And beginning with the *vaſa pampiniformia*, he affirms, that they are made up of a great many Arteries, and of one only Vein, and that this vein, being conſiderably big, is circularly ſcituate, that ſo it may the more conveniently unite it ſelf, by a curiouſly contrived *anaſtomoſis*, to thoſe many Arteries. Then he deſcribeth the *Uſe* of theſe *Pampiniform* veſſels, informing us, That the ſaid Arteries are not *directly* inſerted into the ſubſtance of the Teſticles (as the moſt famous Anatomiſts have believed;) but that they form, on the ſide, another membrane hitherto un-obſerved, (altogether different from the *Albuginea,* and the two others, call'd the *Elytroides,*) which being made up of veſſels, reſembleth the *Meninges* of the Brain, and is by him eſteemed to have the like uſe with it. And thereupon he ſhews, that from the Arteries of that Membrane do preceed ſome ſmall Arteries, for the moſt part double in their origin, but afterwards becoming one, and ſo paſſing into the ſubſtance of the Teſticles; but when they are come to the center of them, returning to the abovefaid membrane without being accompanied by the veins: Where he renders a reaſon, why in the ſubſtance of the *Teſticles* there are no veins;and ſhews,that in the return of the ſaid arteries there appear ſome other ſmall veſſels, which contain no aliment, but only ſeminal matter; and that theſe do frame in the midſt of the Teſticles another whitiſh ſmall membrane, very like the *Septum lucidum*; which membrane, receiving veſſels from all the parts of the Teſticles, except from the back-part, does therefore grow crooked there, and thereby hath deceived that famous Anatomiſt Dr. *Highmore,* perſwading himſelf that it is a round and pervious veſſel. Moreover he ſaith, that the Curvature of the ſaid litle membrane ſerveth for a kind of ventricle, to purge away an aqueous moiſture, ſeparated, by means of the medullar ſubſtance of the Teſticles, from the ſeminal matter contained in the veſſels. He obſerveth further, that the ſmall membrane reſtrains it ſelf towards the upper part, and it being ſuch an one as conſiſts of minute veſſels, there remain yet in that place ſome of them, though very ſmall ones, which may be obſerved by a Microſcope to be diſſeminated in that litle coat, which paſſeth into the *Albigunea* near the *Pampiniform,* and is inſerted into the *Epididymis*; whence paſſing through a glandul above the *Epididymis,*it there depoſeth a wateriſh humidity, like that which the double membrane brings with it from the center of the *Teſticles,*and which through the *Lymphatic* veſſels is conveyed towards the *Vrethra*, and comes away before the ejaculation of the *ſemen prolificum.* And the ſaid litle veſſels afterwards multiplying themſelves exceedingly, and being divided into ſmall Cells, do with a wonderful curious contrivance form the *Epididymis*: Where he diſcovers the errour of him, who believed the *Epididymis* could be ſever'd from the Teſticles without laceration; aſſigning withal the Uſe of that part differently from all other Anatomiſts. There he paſſeth to the *Paraſtatæ Varici-formes*, which emulating the *Epididymis*, appear alſo to be full of pretty big veſſels, ſcituate after a curiouſly contrived manner, and make a nobler ſhew than that of the *Epididymis* it ſelf, it having the reſemblance of an Heart. And declaring the uſe of the *Paraſtatæ*, he ſaith, that they do not terminate in a *nervous* body, but plainly in a *Nerve*, by him call'd the *vas deferens*, which, he eſteems, carries nothing elſe but ſtore of animal ſpirits, which yet according to him are not generated *in* the Brain, (nor tranſported by the Nerves into the Teſticles,) but *in* the ſmall veſſels, which make up the medullar ſubſtance of the very *Teſticles*; which being at laſt obliterated in the *Paraſtatæ*, are changed into a thick membrane, of which is formed the *vas deferens*, ſenſibly pervious; that ſo, by the abolition of the lately mention'd ſmall veſſels, it may receive abundance of ſeminal ſpirits, called *animal*, they being produced from one and the ſame matter, and in one and the ſame manner. And that they are ſo, he further proveth from this obſervation, that the two litle Nerves, taken notice of by Anatomiſts, are inſerted only in the external part of the Teſticles, receiving their internal ſenſe and motion from the ſaid ſpirits, generated as above. And here he maintains, that theſe Spirits are the Senſitive and Moving Soul, and conſequently the *Anima formatrix*, and that there is no other proximate inſtrument, ſave the *Intellective* ſoul, *quæ deforis venit & divina eſt.*

Beſides he endeavours to prove that opinion to be falſe, which holds the *Seed* to be an Excrement of the laſt Aliment, and maketh it out, that a ſmall quantity of Seed excerned, enfeebles more than the loſs of much Blood. He refuteth thoſe that have taught the original of the Seed from the Brain; as alſo thoſe, that have believed it to proceed from the whole Body. He aſſigneth the manner, how this Spirit is corporified and incraſſated, and why 'tis ſo? proveth experimentally, that being ſubtilized by the warmth of the *Vterus*, it becomes a very fine Spirit; refuting, on this occaſion, the opinion of *Galen*, importing that from the corpulency of the *Semen virile* the ſpermatick parts are generated, and aſſerting on the contrary, that theſe are formed *de ſero utili ſanguinis menſtrui.* By the ſame Experiment he undertakes to evince, that Dr. *Harvey* was miſtaken, believing the *Vterus* to be immaterially made fecond, when he found nothing of a ſeminal body in the wombs of all thoſe Animals open'd by him. Beſides he teacheth, how the *Semen* is mixed *cum menſtruis*; and how it is moved ſutably to the diverſity of kinds. He examins, how the ſolid parts are generated, and refuting all other opinions about this point, he maintains that they are produced all at once, though they be diſcern'd at different times, according to the greater or leſs neceſſity of thoſe parts. He ſhews, how they become ſenſitive, and begin to have life, contending that they are not nouriſh'd till they are ſenſible. He explains, from what cauſe and for what end the Heart is moved; what thing the *punctum ſaliens* is, and upon what account it hath been reputed to be the Heart. And having attempted to reſolve many difficulties, he thinks he hath determined many other curious and conſiderable particulars by experimented principles.

Dr. Wallis'*s opinion concerning the* Hypotheſis Phyſica Nova *of Dr.* Leibnitius, *promiſed in* Numb. 73. *and here inſerted in the ſame tongue, wherein it was written to the Publiſher,* April. 7. 1671.

Clariſs. Vir,

Legi ego ſemel atque iterum, quam impertiiſti, Dn. Leibnitii *Hypotheſin Novam, de qua opinionem meam petitis,*

Authe-

Authorem quod ſpectat, ut ut de nomine (quod memini) mihi ignotum prius, æſtimare tamen debeo, ut qui, in magno loco inter magna negotia poſitus, vacare tamen poteſt liberæ philoſophiæ, & rerum cauſis inveſtigandis, quique ad multa reſpexiſſe videtur. Opus quod attinet, multa ibi reperio ſumma cum ratione dicta, quibuſque ego planè aſſentior, ut quæ ſint ſenſis meis planè conſona. Talia ſunt; Debere Phyſicum ad Mechanicas rationes, quod ejus fieri poteſt, omnia accommodare, §.15. Nihil ſeipſum, ex abſtracti Motûs rationibus, in lineam priorem reſtituere, etiam ſublato impedimento, niſi accedat nova vis, §.22. Omnia corpora ſenſibilia, ſaltem dura, eſſe Elaſtica, *atque* ab Elatere oriri Reflexionem, §. 21. (*Quæ meis de Motu hypotheſibus Tranſactionibus Philoſophicis* * *jam antehac inſertis, omninò congruunt; quæque in Mechanicis ſeu* de Motu Tractatu *fuſius proſequor* cap. 11: 13.) *Item*, Attolli gravia, non metu Vacui, ſed propter Atmoſphæræ æquilibrium, §. 25. Levitatem *verò* per accidens tantùm ſequi ex Gravitate, gravioribus minus gravia ſurſùm pellentibus, §. 24. Irruptiotionem Aeris (ſed & Aquæ, *&c.*) in vas exhauſtum, ob Aeris Gravitatem & Elaterem fieri, §. 26. *Nec non*, Exhauſti atque diſtenti (*ut loquitur*) effectus, unde Fermentationes, deflagrationes & diſploſionum omne genus; nempe diſplodente altero quod alterum abſorbet (*ſeu admittit potiùs*,) §. 27. 39, 40. *Nam & hæc etiam ab Elatere fiunt, in Contento, vel in Continente, vel in utroque*; illîc, *explicante ſe quod nimis fuerat compreſſum*; hîc, *contrahente ſe quod nimis diſtentum fuerat*; *quippe utrovis modo, nedum utroque, fiet irruptio vel exploſio, dummodo locus ſit quò recipi ſine impedimento poſſit quod ejiciendum fuerit. Suntque hæc planè conſona traditis noſtris* Mechan. c. 14.

* Numb. 43.

Sed & illud, Gravitatem in Inferioribus oriri ex motu (*vel preſſu*) ſuperioris Ætheris, §. 13. 16. *magnâ ſaltem veriſimilitudine dicitur. Quanquam enim gravitatis cauſa (ut & Elateris) tam ſit in abſcondito, ut mihi nondum uſquequaque ſatisfactum ſit quid in ea re ſtatuam, Naturæ tamen phænomena*, Pulſione *quàm* Tractione *feliciùs utplurimum explicantur*

cantur. Aliáque multa ſunt quæ repetitu non eſt opus, quæ magnâ veriſimilitudine, ſi non & certitudine, dicta judico; quæque per ſe ſatis conſiſtunt independenter ab aliis: neque enim ita inter ſe connexa ſunt omnia, ut uno vacillante cætera ſimul ruant.

De tota verò Hypotheſi ne quid ſtatim pronuntiem, id ſaltem facit, quòd non ſim pronus Ego (in rebus ſaltem pure Phyſicis, non Mathematicis,) aſſenſum novis placitis adhibere, donec vel Eruditorum ſententiis in utramque partem ventilatis quid ſtatuendum ſit rectiùs conſtet, vel ipsâ ſui evidentiâ (quod in veris Hypotheſibus non rarò fit) veritas eluceat. Fundamentum Hypotheſeos Novæ *repetit ex* Abſtracta ſua Motûs Theoria *(quam non vidi, ut nec Tractatûs hujus poſteriora, quæ paſſim citantur**,) *nempe,* Quod nulla ſit Cohæſio Quieſcenties, ſed omnis conſiſtentia ſeu cohæſio oriatur à Motu, §. 7. 12. 34. (*quod cum* Gulielmi Nelii * *noſtri placitis coincedit.) Contra verò Honoratiſſimus* Boylius, *cum aliis, Conſiſtentiam in particularium quiete, & Fluiditatem in earundem continuo motu collocat. Alii ad varias Atomorum figuras, hamatas & variè implicitas, rem referunt. Neque ego is ſum, qui in tanta ſententiarum varietate me vellem arbitrum interponere. Sed tempori res permittenda eſt, & doctorum in utramque partem rationibus. Quippe idem ferè obtinet in novis Hypotheſibus, quod in Oſcillationibus Pendulorum; ubi, poſt crebras hinc inde reciprocationes factas, tandem in perpendiculo fit quies. Id vidimus in* Hypotheſi Copernicana, *quæ utut fuerit Veteribus cognita, tamdiu tamen ſepulta jacuit ut pro* Nova *haberetur: Et quamvis optimâ eſſet ratione ſuffulta, non tamen ſtatim obtinuit, ſed à variis fuit variis modis impetita, & acriter diſceptata, donec tandem rationibus authoritati prævalentibus ita jam univerſim admittitur, ut vix quiſpiam harum rerum gnarus de ea dubitet niſi quibus Cardinalium decretum præjudicio eſt. Et quanquam* Tycho *novam illius loco ſubſtituerit quæ illi equipolleret, tot tamen ea in-*

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* Primâ enim vice nonniſi Hypotheſeos hujus priorem partem, ad uſqne ſcil. p. 48, Author per literas tranſmiſerat, ſine *Abſtracta Motûs Theoria.*

* Juvenis hic erat geniò planè philoſophico, è *Societate Regia*, præmaturâ nuper morte nobis ereptus.

commodis eſt onerata, ut exiſtimandus videatur potiùs ad frangendam invidiam id feciſſe (quoniam Telluris Motus ita vulgi opinionibus horribilis videbatur,) quàm quod Copernici *Hypotheſin ex animo repudiaverit. Idem dicendum de* Circulatione Sanguinis Harvæana, *quæ utut optimè fuerit ſtabilita, & oculorum* αὐτοψίᾳ *comprobata, diſceptata tamen fuit inter Londinenſes Medicos viginti plus minùs annis antequam in publicum prodiret, & ab aliis deinceps: Quæ tamen poſt maturam rei penſitationem (quod tempori dandum erat) ab omnibus ut indubitata recipitur. Sic* Galilæi Hypotheſis (*ob Antlias, aquam non ultra certam altitudinem attrahentes, primùm excogitata) quam* Torricellius *in graviori liquido adeóque magis tractabili promovit, Æquilibrium Atmoſphæræ pro Veterum* Fuga vacui *ſubſtituens, non niſi poſt diutinas hinc inde diſputationes eum apud viros doctos locum obtinuit quem jam habet. Idem dicendum de* Jolivii *noſtri* Vaſis Lymphaticis, *ante multos annos Medicis Londinenſibus ab illo indicatis atque ab eis admiſſis & approbatis; quæ tamen ita rationi conſona reperta ſunt & oculari inſpectioni manifeſta, ut tandem longo pòſt tempore inter alios aliquot acriter diſputaretur, quis eorum primus Inventor fuerit,* &c. *Idem in hoc negotio aliiſque Novis hypotheſibus exſpectandum, quæ nec oculi inſpectione nec certâ demonſtratione probari poſſunt, ut ſi veris rationibus fundatæ ſint, tandem, ſed non niſi poſt velitationes utrinque factas, in liberè philoſophantium animis locum obtineant; interea pendulæ manſuræ. Clariſſimo interim Viro habendæ gratiæ, qui eam de* Societate *noſtra opinionem concepit, ut ſenſa ſua illis communicare, novámque ſuam* Hypotheſin *(rem certè ipſis non ingratam) exhibere dignatus fuit.* Vale.

Tuus

JOHANNES WALLIS.

After that the other part of this Tract was (a great while after) come to hand, namely *De Abſtracta Motûs Theoria*, and ſent alſo to the ſame Dr. *Wallis*, he made this return to it in a Letter of *June* 2. 1671.

Clariſſ. Vir,

Accepi nuperrimè à Te tranſmiſſam D. Leibnitii Theoriam Motus Abſtracti, *de qua judicium meum petitur. Duo autem ſunt quæ ſuadeant ne illud præſtem. Alterum, quòd res invidioſa videatur de aliorum ſcriptis cenſuram agere: Alterum, quod occupatiſſimo tempore huc advenerit, quo ægrè vacavit ſemel atque iterum attentius perlegere, nedum omnia penſiculatius conſiderare. Quoniam verò Tu id expetis, hæc pauca dicam. Multa ſcil. inibi contenta Ego planè approbo, ut ſubtiliter & ſolidè dicta, quæque Virum curioſum & cogitabundum indicant. Si pauca ſint quibus non ſtatim aſſentiar, ignoſcet, ſpero, vir humaniſſimus. Et ſpeciatim, fateor, mihi nondum ſatisfactum eſſe, ut, primis ſaltem cogitationibus, ſtatim aſſentiar, Cohæſionem omnem ex continuo celerique ſed inobſervabili particularum motu fieri (quod ille* Theoriæ motus Concreti *fundamentum ponit;) uti nec pridem, cùm ante aliquot annos, ſimilem* Quietis *& Cohæſionis cauſam aſſignaverat* Nelius *noſter. Quid olim aliquando futurum ſit, poſt rem accuratiùs perpenſam, nec dicere poſſum nec prævidere. Interim ego ἀπέχω, nec quicquam in aliorum præjudicium pronuntio; quin liberum cuique ſit, eam quam rationi magis conſentaneam judicaverit, ſententiam amplecti.* Vale.

Tuus
JOH. WALLIS.

An Accompt of ſome Books.

I. A Diſcourſe touching the *ORIGINAL OF HUMAN LITERATURE*, both *PHILOLOGY* and *PHILOSOPHY*; in two Parts: By *Theoph. Gale* M. A. Oxford, 1669. and 1671. in 4°.

The Buſineſs of this Book is, to derive *Human Arts* and *Sciences* from the *Jewiſh Church*; for the doing of which the Author profeſſeth he hath been encouraged by conſiderable hints and aſſiſtances of the *Scaligers*, and of *Grotius*, *Voſſius*, *Bochartus*, *Selden*, *Uſher*, *Preſton*, and others, beſides the concurrent teſtimonies of many of the Ancients.

In the *Firſt* part he endeavours to prove, that all *Languages* have their origin and riſe from the *Hebrew*; inſtancing particularly in the *Oriental* Tongues, as the *Phenician*, *Copthic*, *Chaldaic*, *Syriac*, *Arabic*, *Perſian*, *Samaritan*

and *Ethiopic*; and then in the *European*, eſpecially the *Greek*, *Latin*, the old *Gallic* and *Brittannic*. To which he adds a deduction, importing, that the Pagan Theology, Phyſick, Politicks, Poeſie, Hiſtory, Rhetoric, are traduced from Sacred Names, Perſons, Rites and Records; and ſhewing withal, How the Jewiſh Traditions came to be corrupted and miſtaken by *Pagans*.

In the *Second* part he maketh it his buſineſs to evince, that *Philoſophy* alſo hath its Original from the *Jewiſh Church*; beginning to ſhew this of the *Barbaric* Philoſophy, under which he comprehends the *Egyptian*, *Phenician*, *Chaldean*, *Perſian*, *Indian*, *Ethiopic*, *Scythian*, and *Britannic*; and thence proceeding to the *Grecian*, and chiefly to the *Ionic*, and *Italic* or *Pythagorean*; where he ſhews great reading and learning, whil'ſt he deduceth this doctrine of Judaic Origin from the Teſtimonies of Heathen, Jewiſh, and Chriſtian, both Ancient and Modern, Authors; paſſing through all the particular *Sects* of Philoſophers with great ſolicitude and induſtry; and promiſing at the end of this Work, that he is willing to undertake another Treatiſe, to ſhew both the *Miſchief* of *Vain*, and the *Vſefulneſs* of *Sound* Philoſophy to Chriſtian Religion, if this Hiſtorical Accompt, deliver'd in theſe two Parts, (and mainly deſigned in Order thereunto) find any ſuch reception, as may give encouragement to ſuch Labours.

II. *Joh. Joachimi Becheri* Spirenſis Med. Doct. *EXPERIMENTVM CHYMICVM NOVVM*, quo Artificialis & Inſtantanea Metallorum *Generatio* & *Tranſmutatio* ad oculum demonſtratur. Francofurti, A. 1671. In 8°.

This Tract was written by the Authour as a *Supplement* to his *Phyſica Subterranea*, likewiſe printed at *Frankford*, about two years ſince, though yet but in part, there being hitherto extant only the firſt Book of the two, of which it is to conſiſt: which *Firſt* part (to give ſome accompt of it on this occaſion) undertaketh to explain both the abſtruſe Generation of Subterraneous things, and the admirable Fabric of the Super-terraneous and Subterraneous complex Globe of Earth, Air and

Water: Promiſing to deliver hereafter in the *Second* Book, the *particular* Nature of under-ground Bodies, and withal to teach the Reſolution of them into parts and the proprieties of thoſe parts; together with an *Appendix* that ſhall contain a great number of Chymical Mixtures, never ſeen before, and grounded upon numerous Experiments. We cannot forbear giving the Reader, of that great variety of matter and Trials, contain'd in the ſaid First Book, one very conſiderable Experiment, ſaid to have been actually made by the Authour himſelf, and which ſeems worth repeating for further obſervation and improvement. It is in ſhort this, as it may be found *p.* 170, 171. *Phyſicæ Subterraneæ*.

Having a mind, for a certain end, to melt a *Jaſper*, he ſaith, he put it into a crucible, and actually melted it by an intenſe fire, and ſome other requiſites neceſſary to the operation. But to the end that no coals might fall into the paſt, he cover'd and luted the crucible, which was about half fill'd with Jaſper-ſtone: which being now melted, he open'd the crucible when cool, and, to his great wonder, found at the bottom the Jaſper melted together into one Maſs, as hard as before, but Milk-white and half opaque, reſembling a natural *White* Agat; but the cover, and the upper parts of the crucible, that were un-fill'd, and could not be touched by the Jaſper in the melting, were tinged with the natural colour of the Jaſper; inſomuch that if there had been the hardneſs of a Jaſper and the colour not ſuperficial only, the fragments of the crucible might have been ſold for the beſt and moſt poliſh'd Jaſper, having here and there greeniſh ſtreaks and ſpecks, the reſt being red and yellowiſh; all ſo beautiful, that a good Painter would ſcarce have been able to imitate thoſe various colours. Of this, the Author ſaith, he keepeth ſtill the peices in his Laboratory at *Munchen* in *Bavaria*, as a very extraordinary treaſure; eſteeming that thoſe upper parts were tinged by the *anima* of the Jaſper, driven up by the force of the fire from its inferiour part, and adhering to the body of the crucible.

Having thus related this uncommon experiment, we

ſhall

ſhall proceed to ſay ſomething of the Contents of this *Supplement*, which occaſion'd that relation. It ſeems then, that the learn'd Dr. *Rolfink*, Profeſſor of Phyſick in the Univerſity of *Jena* in Upper Saxony, in his Book, entitled, *Chymia in Artis formam redacta*, affirms, that the current Mercury of Bodies is a *Non-Ens*: which our Author looking upon as an ungrounded and precarious Aſſertion, labours in this Tract to confute it, from Authority, Reaſon and Experiment, as may be ſeen *pag.* 81, *&c.* That which we ſhall take here particular notice of, is that Chymical Experiment, which giveth the Title to the Book, and is called *New*, alledged to prove the real and ſudden Generation and Tranſmutation of Mettals. You may take it thus, if you pleaſe;

He took common Brick-earth, dry'd it in the Air that it might be ſifted; then poured ſo much Linſeed-oyl upon it as that he might role it into little balls, of the ſize of the Retort's neck, which they were to be put into, to the end, that the diſtillation being made, he needed not to break his retort for the taking out of the *Caput mortuum*, but might reſerve it for other uſe. That the fire might the more forcible penetrate thoſe globuls, than if the matter were in one Maſs, he filled the Retort with them, and by degrees diſtill'd them with an open fire, during an hour or two. This diſtillation being finiſh'd, he found in the Recipient an Oyl almoſt like that, which he ſaith is improperly call'd *Oleum Philoſophorum*; then the Retort being cool'd, he took the little balls out of it, which not being found red, by ſo ſtrong a fire, but very black, he ſuſpected that blackneſs proceeded from the Oyl, ſome terreſtrial parts of which, being fix'd and ſever'd by vertue of the Brick-earth, might there have aſſumed a Body; which of what kind it was, was now further to be examin'd by trial. Having therefore beaten ſmall theſe black globuls, and ſifted them, he put them into a diſh, and having powr'd ſome common water upon it, he ſtirr'd it; then being grown turbid, he gently powred it off, and powred on freſh clear water, ſtill ſtirring the matter: which he ſo often repeated and continued, till the water came clear away, and there remain'd at the bottome of the diſh a ponderous black ſediment, which from its weight and ſudden ſubſidence, as alſo from its dark colour he ſuſpected to be of a Metallick, and indeed of an Iron nature; which being dry'd upon paper, upon the application of a Load-ſtone, was thereby attracted in ſeveral grains, which by all proofs he found to be very good Iron.

Eſteeming hence, that ſulphureous Spirits may be fixed by a certain Earth as their *Matrix*; he ſaith, that he employ'd the ſame method with all Minerals, Sulphurs, and Mercury it ſelf, and accordingly melted various Minerals with various Earths and Clays; whereby he diſcovered many Truths & Tranſmutations. And to convince his Readers of the reality of this Experiment, he ſpends a whole Chapter to prove the truth of the matter of fact, and of the genuineſs of the Iron produced; examining withal, whether that Iron thus produced had not been latent either in the Earth, or in the Oyl, and ſo might have impos'd upon him; and having found, it had not, he inquireth, what may be the *Metallick* cauſe in *general* in this Experiment; and in *particular*, what the *Ferrifick* (if we may be allow'd to frame ſuch a word) or the Iron-making Principle, *&c.*

III. De *ABSYNTHIO* Analecta, per *Joh. Michael Fehr*, M. D. *Lipſiæ* 1668 in 8°.

Several Learn'd men in *Germany*, having aſſociated themſelves, ſome years ſince, into a Company under the Name of *Academia Naturæ Curioſorum*, reſolved to undertake, each of them, the Deſcription of ſome particular ſubſtance in Nature, conſidering with themſelves how long the world had been fruitleſly amuſed with Generals: Of thoſe particulars we only named ſome in *Numb.68. p.*2078. but ſhall now endeavour to give an accompt in the remainder of this Tract, of ſome performances of theſe undertakings;

Beginning here with the Treatiſe concerning *Wormwood*; which but very lately came to our hands. In it the Author deſcribeth *firſt* its Nature, enumerateth its differences, obſerveth its vertues, teacheth divers preparations, and delivers its manifold Uſes, eſpecially in ſtrengthening and recovering the ſtomack and all the parts of the lower Belly; in curing the Colick, Scurvy, Jaundies, Dropſie, &c. in opening the Obſtructions of the Liver and Spleen; in expelling Worms, and driving away Moths, and other like vermine, &c.

After this, he endeavors to ſolve divers *Queſtions* propoſed upon this ſubject, as, 1. Whether the bitterneſs may be taken away from Wormwood without deſtroying its vertues? which is reſolved in the Negative. 2. Whether the Salts, called Eſſential, have the ſame vertue with their Simples? *Anſw.* in the Affirmative. 3. Whether the Reſuſcitation of Plants be naturally poſſible? Affirm'd, as to their rerepreſentation, &c. *Laſtly*, he concludeth with an Enumeration of *Bitter* things; which are found among Roots, Herbs, Stalks, Leaves, Flowers, Seeds, Berries, Fruits, Barks, Wood, Gums, Juyces, Oyls, Extracts, Powders; obſerving withal, that generally all *Bitter* things have the power to comminute, to be aſterſive, opening, and purgative, more or leſs.

CROCOLOGIA. Auth. *Joh. Ferdinando Hertodt* M. D. *Jenæ* 1671. in 8o.

This Author giveth us the Anatomy of *Saffron*, and having deſcribed it, and aſſigned its differences from its different nature, time of production, colour, flower, leaves; and withal found the ſeveral Country's of its growth, and ſhew'd the way of its Culture and Propagation: He proceeds to relate its Vertues and Uſes; in the doing of which he recommends it, and the ſeveral preparations thereof (of which he ſets down not a few,) againſt the Head-ache, Palſy, Vertiginous diſtempers, Epilepſie, Lethargy, Intercepted Reſpiration (call'd the *Incubus*,) Phrenſie, Inflammations and Suffuſions of the Eyes, Tingling of the Ears, Squinancy, Cough, Pleuriſie, Palpitation of the Heart, Nauſeouſneſs, Hæmorrhoids, Dyſenteries, Diarrhæa's, Colicks, Inflammation of the Liver, Dropſie, Jaundies, Obſtructions of the Liver and Spleen, Hypochondrical diſtempers, the Stone, the difficulty of Excretion by Siege or Urine, the Green ſickneſs, Infecundity, Suppreſsion of the *Menſtrua*, Hyſteric paſsions, Hard Travel Inflammation of the Breaſts, Burnings, Gangrens, the Kings Evil, &c.

This Enumeration being made, and a great number of Receipts, of which Saffron is the chief Ingredient, interſperſed, there are ſubjoyned ſeveral *Quaries*, viz.

1. Whether Saffron be an Antidote to the poyſon of *Napellus?* It being affirmed ſo to be, the Author adds a Relation of a conſiderable Phyſitian concerning the *Polanders* frequent and harmleſs eating of *Napellus* in their Salats; the reaſon whereof is aſcribed to the common uſe of Saffron by that people.

2. Whether Saffron removeth or cauſeth a ſurfet? This is treated as diſputable.

3. Whether it induceth ſleep or wakefulneſs? And this queſtion is here debated, *pro* and *con*, yet ſo as that the Author endeavours to reconcile the diſputing parties.

4. Whether *Saffron* tingeth the *Fœtus* in the womb? Here are alledged ſeveral Experiments for the affirmative, of which the Author ſaith to have made one upon a Bitch with puppy, which brought her young ones forth yellowy-colour'd, after he had given her, for a good part of her bearing time, all her meat and drink tinged with Saffron, and for three dayes, immediately before her whelping, put ſome drachms of Saffron in her broth.

There are alſo inſerted ſome Mechanical uſes of this Vegetable for tinging of Hair yellow; for making a liquor to write golden-colour'd Letters with; and gilding of Leather, *&c.*

IV. De *LAUDANO OPIATO*, Auth. *Matth. Tillingio* M.D. *Francofurti*, 1671. in 8°.

This Treatiſe hath four Parts. The firſt contains the Origin of the *Opiat Laudanum*, and the Praiſes of its Uſefulneſs in general; together with a diſquiſition of its Temperament, and whether *Opium* be poyſonous in its ſelf, and may be uſed uncorrected, *&c*? The latter part of which queſtion is here reſolved in the *Negative*.

The *Second* treats of the genuine correction of *Opium*; delivers ſeveral deſcriptions of the Opiat Laudanum, much eſteem'd both by Galenic and Chymical Phyſitians; preſcribeth the Doſe and way of uſing it; and withal anatomiſeth and ſtrictly examins his own preparation of this Medicin; adding ſome cautions to be obſerved in the Uſe thereof.

The *Third* contains various Compoſitions of Opiat Medicines, or ſuch as have Opium or the Opiat Laudanum for their chief Ingredient; together with an enumeration of their particular Vertues.

The *Fourth* ſpecifieth thoſe Maladies and diſtempers, in which this *Laudaum* is ſingularly beneficial, made out both by Reaſon and the obſervation of the Authour aswell as of many other famous and worthy Phyſitians. Here are reckon'd up Head-aches, Sleepleſneſs, Phrenſies, Giddineſs, the Falling ſickneſs, Hæmorragies, Pleuriſies, Bloud-ſpitting, Coughs, Conſumptions, Faintings and Soundings, Feavers, Colicks, Fluxes, virulent Gonorrhæa's, Hyſterical diſtempers, *&c.*

As to the ill ſucceſs which at times hath attended the taking of *Laudanum*, our Authour aſcribeth *that* either to the unskilful preparation, or the unſeaſonable and indiſcreet exhibition of it. In the preparation he obſerveth, that the malignity that is in *Opium*, is beſt corrected by *Alcaly*'s, as having the force of taming that Narcotic ſulphur, contain'd in it; agreeing herein with *Helmont*'s Maxim, *Omne Narcoticum perit in Alcaly.*

Advertiſements.

Since the printing of the foregoing particulars, there came to hand the New Obſervations above mentioned, of the *Spots of the Sun*, in Print, made at the *Royal Academy* in *Paris*, the 11th, 12th, and 13th of *Auguſt*, 1671. (*ſt. n.*) by Signor *Caſſini*; who intimateth at the end of his *French* Narrative concerning the ſame (which is intended to be *Engliſh'd* for the next Tract,) that from about *Sept.* 4th, until *Sept.* 18. (*ſt. n.*) it will be worth while to obſerve, whether the ſame Spots after they have paſſed over the upper Hemiſphere of the Sun, which is hidden to us, will not return again and appear in its apparent Diſque.

The ſame Spots have been obſerved, (as by a Letter from Dr. *Fogelius* at *Hamburg* we were alſo very lately inform'd,) at Sea near the *Teſſel*, by M. *Picard*, one of the Royal *Pariſian* Philoſophers, namely *Aug.* 3. (*n. ſt.*) and ſome of the following days; as alſo at *Hamburg* the 7th, 8th, 9th of *Auguſt*, (*n. ſt.*) Of which more alſo by the next opportunity.

What we have to add now (which muſt not be defer'd) is the Prediction, made by the ſame Signor *Caſſini*, of the Eclipſes of the *Satillits* of *Jupiter*, calculated for *Uraniburg*, and annexed here, to the end that our Aſtronomers, having reduced them to our *Latitude* and *Longitude*, may alſo obſerve the ſame.

***The Immerſions of the* Satellits *of* ♃ *into its ſhadow, viſible at* Uraniburg, *A.* 1671.**

Sept. 25.	*Immerſio* 1^{mi} *mane*	h.4.16′
Oct. 11.	*immerſ.* 2^{di}	h.4 26.
18.	*imm.* 1^{mi}	h.4.43.
25.	*imm.* 1.	h.6.41.
Nov. 7.	*imm.* 3.	h.2.37.
10.	*imm.* 1.	h.4.51.
12.	*imm.* 2.	h.4.18
14.	*im.* 3.	h.6.37.
17.	*imm.* 1.	h. 6.49.
19.	*imm.* 1.	h. 1.20.
	& 2^{di}	h.7.1.
26.	*imm.* 1.	h.3.10.
Decemb. 3.	*imm.* 1.	h.5.8′.
8.	*imm.* 4^{ti}.	h 0.10.
	Emerſio	h 5.10.
12.	*imm.* 1.	h.1. 29.
14.	*imm.* 2.	h.4.6.
19.	*imm.* 1	h 3.19.
20.	*imm* 3.	h 1.52.
21.	*imm.* 2.	h.6.49.
26.	*imm.* 1.	h. 5. 9.
27	*imm.* 3.	h.5 22.

Errata. In Numb. 73. p. 2202. l. ult. r. *ſecandâ*, p. 2204. l. 24. r. *pauciores*, p. 2205. l. 38. r. *ut* 2 *ad* √5--1. p. 2206. l. 40. r. *MK ad Md.* p. 2207. l. 11. r. (*pag.* 49, *l.* 22.) ibid. l. 29. r. *quippe qui ne.* p. 2208. l. 41. r. *menda.* l. 43. r. *erant*, p. 2214. l. 8. inſtead of *Bodlejan* r. *Pocockian*; for it was in Dr. *Pocok*'s own Library.

In this *Numb.* 74. p. 2214. l. 10. r. *how* for *here.* p. 2226. l. 9. r. *thence he*, p. 2228. l. 8. r, *quoad ejus.* p. 2229. l. 16. *quieſcentis.* ib. l. 19. *coincidit.*

London, Printed for *J. Martyn*, Printer to the Royal Society, 1671.

PHILOSOPHICAL TRANSACTIONS.

Septemb. 18. 1671.

The CONTENTS.

A Supplement to what was publiſh't N. 73. *of the* Compreſſion of Air *under* Water. *An Anſwer to Four Papers of Mr.* Hobs, *lately publiſh't. New Obſervations of* Spots *in the* Sun. *An Accompt touching* Vegetable Excreſcencies. *A Deſcription of ſome Books:* I. & II. *Lectiones OPTICÆ & GEOMETRICÆ, Auth.* Iſaaco Barrow; *together with a* Mantiſſa *of the ſame Author to ſome of thoſe Lectures.* III. *A Continuation of the MEMOIRES of M.* Bernier *concerning the Empire of the G.* Mogol. IV. *Hiſtoria & Meteorologia INCENDII ÆTNÆI. A.*1669. *Auth.* Joh.Alph.Borello. *Advertiſement touching the* Latin *Verſion of part of theſe* Tranſactions.

A Supplement to what was publiſh't N. 73. *of the* Compreſſion of Air *under* Water.

AT the deſire of a particular Friend, the *Scheme* in *Tab.* I. *Fig.*I. was drawn, and is now permitted to be made publick at the requeſt of another, by way of Supplement to what was ſaid in the *Philoſophical Tranſactions* N. 73. of the Compreſſion of Air under Water: In which *Figure*

ED is made to repreſent the Tube, = x.

AB the diſtance of the upper part of the Tube from the ſurface of the water above or under it, = b.

FC the depth of the water from its ſurface to the bottom of the Air within the Tube, = a.

BC that part of it which remains fill'd with Air within the Water.

CD the reſt thereof which is full of water.

And any two of the three firſt, x, b, and a, being given, the other is known, and conſequently the reſt alſo.

For, if by the incumbent weight of 33 feet depth in water, the Air in the tube is compreſt into half the ſpace it fill'd before; then the ſaid 33 feet depth of Water equals the weight or preſſure of the incumbent Air on the ſurface of the Water.

Now, as the weight or preſſure of the Air on the ſurface of the Water, is to the Depth of the Water from the ſurface thereof to the bottom of the Air within the Tube; ſo is the Length of the Tube fill'd with Air, to the length thereof fill'd with Water: That is, according to the ſaid Experiments, putting z for 33, or whatever, at other times or places, ſhall be found to be the weight or preſſure of the incumbent Air on the ſurface of the Water, (for it is not always the ſame exactly;) $z.\ a\ ::\ a \pm b.\ \frac{a^2 \pm ab}{z} = CD.$

And therefore $\frac{a^2 \pm ab + za \pm zb}{z} = x.$

Wherefore $\frac{z}{z+a} x - a = b.$

And $\frac{\sqrt{:b^2 \mp 2zb + z^2 + 4zx:} \mp b - z}{z} = a.$

And therefore *a* and *b* being given, x is known to be the firſt æquation; And *a* and x being given, *b* is known by the ſecond; And *b* and x being given, *a* is known by the third.

The Horizontal line BFBAF is ſubſtituted for GABEFb, when the Cloſe end of the Tube is not even with the ſurface of the Water, to avoid the breach $cC = bB = \frac{1}{4z} b^2$ in the length of the Tube.

Note,

That the Perpendicular immerſion of the Tube or Cylinder, ſpoken of in the ſaid *Tranſactions* N. 73. is not to be underſtood of the Depth of the bottom or open end in the water, but of the Depth of the Air within the Tube or Cylinder from the ſurface of the water, *viz.* FC, not FD.

An

An Anſwer to Four Papers of Mr. Hobs, *lately Publiſhed in the Months of* Auguſt, *and this preſent* September, 1671.

In the former part of his firſt Paper;

BY reaſon of a Propoſition of Dr. *Wallis* (*Prop.* 1. *Cap.* 5. *De Motu*) to this purpoſe (for he doth not repeat it *Verbatim*:) *If there be ſuppoſed a row of Quantities infinitely many, increaſing according to the natural Order of Numbers,* 1,2,3,&c. *or their Squares,* 1,4,9,&c. *or their Cubes,* 1,8,27,&c. *whereof the laſt is given. It will be a row of as many, equal to the laſt, in the firſt caſe, as* 1 *to* 2; *in the ſecond caſe, as* 1 *to* 3; *in the third, as* 1 *to* 4, &c. (Where all that is affirmed, is but; *If we SUPPOSE That; This will Follow.* Which Conſequence Mr. *Hobs* doth not deny: and therefore all that he ſaith to it, is but Cavilling.)

Mr. *Hobs* moves theſe Queſtions, (and propoſeth them to the *Royal Society*, to paſs a judgment on them.) 1. *Whether there can be underſtood* (he ſhould rather have ſaid, *ſuppoſed*) *an infinite row of Quantities, whereof the laſt can be given.* 2. *Whether a Finite Quantity can be divided into an Infinite Number of leſſer Quantities, or a Finite quantity conſiſt of an Infinite Number of Parts.* 3. *Whether there be any Quantity greater than Infinite,* 4. *Whether there be any Finite Magnitude of which there is no Center of Gravity.* 5. *Whether there be any Number Infinite.* 6. *Whether the Arithmetick of Infinites be of any uſe, for the confirming or confuting any Doctrine.*

For anſwer. In general, I ſay, 1. Whether thoſe things *Be* or *Be not*; yea, whether they *Can* or *Cannot be*; the Propoſition is not at all concerned, (which affirms nothing either way;) but, whether they can be *ſuppoſed*, or made the *ſuppoſition, in a conditional Propoſition.* As when I ſay, *If* Mr. Hobs *were a Mathematician, he would argue otherwiſe*; I do not affirm that either *he is*, or ever *was*, or *will be* ſuch. I only ſay (upon ſuppoſition) *If he were*, what he is not; he would not do as he doth. 2. Many of theſe *Quære's* have nothing to do with the Propoſition: For it hath not one word concerning *Gravity*, or *Center of Gravity*, or *Greater than Infinite.* 3. That uſually in *Euclide*, and all after him, by *Infinite* is meant but, *More than any aſſignable Finite*, though not Abſolutely Infinite, or the greateſt poſſible. 4. Nor do they mean, when Infinites are propoſed, that they ſhould *actually Be*, or be *poſſible to be performed*; but only, that they be *ſuppoſed*. (It being uſual with them, upon *ſuppoſition* of things *Impoſſible*, to infer uſeful Truths.) And *Euclide* (in his ſecond *Poſtulate*) requiring, *the producing a ſtreight line Infinitely, either way*; did not mean, that it ſhould be *actually performed*. (for it is not poſſible for any man to produce a ſtreight line Infinitely;) but, that it be *ſuppoſed*. And if AB * be *ſuppoſed* ſo produced, though but one way; its length muſt be *ſuppoſed* to become *Infinite* (or *more than any Finite length aſſignable*;) For, if but *Finite*, a Finite production would ſerve. But, if ſo produced both ways; it will be yet *Greater*, that is, *Greater than that Infinite*, or Greater than was neceſſary to make it more than any Finite length aſsignable. (And whoever doth thus *ſuppoſe Infinites*; muſt conſequently *ſuppoſe, One Infinite greater than another.*) Again, when (by *Euclide's* tenth Propoſition) the ſame AB *, may be *Biſected* in M. and each of the halves in *m*, and ſo onwards, *Infinitely*: it is not his meaning (when ſuch continual ſection is propoſed) that it ſhould be *actually done*, (for, who can do it?) but that it be *ſuppoſed*. And upon ſuch (*ſuppoſed*) ſection *infinitely continued*, the parts muſt be (*ſuppoſed*) *infinitely many*; for no *Finite* number of parts would ſuffice for *Infinite* ſections. And if further, the ſame AB ſo divided, be *ſuppoſed* the ſide of a Triangle ABC *; and, from each point of diviſion, *ſuppoſed* lines (as mc, Mc, &c.) parallel to BC: theſe parallels (reckoning downward from A to BC) muſt conſequently be (*ſuppoſed*) *infinitely many*; and thoſe, in *Arithmetical progreſſion*, as 1, 2, 3, &c. each exceeding its Antecedent as much as that exceeds the next before it;) and, *whereof the laſt* (BC) *is given*: (and their Squares, as 1, 4, 9, &c. their Cubes, as 1, 8, 27, &c.) And this I ſay, to ſhew that the *ſuppoſition of Infinites* (with theſe attendants) is not ſo new, or ſo *Peculiar* to *Cavallerius* or Dr. *Wallis*, but that *Euclide* admits it, and all Mathematicians with him; as at leaſt *ſuppoſable*, whether *Poſſible* or not.

* See *Tab.* 1. n. II.

* See *Tab.* 1. n. III.

* See *Tab.* 1. n. IV.

In particular, therefore, to his *Quære's*, I anſwer, 1. There may be *ſuppoſed* a row of Quantities *Infinitely many*, and *continually increaſing*, (as the ſuppoſed parallels in the Triangle ABC, reckoning downwards from A to BC,) *whereof the laſt* (BC) *is given*. 2. A Finite Quantity (as AB) may be *ſuppoſed* (by ſuch continual Biſections) diviſible into a number of parts *Infinitely many* (or,more than any Finite number aſsignable:) For there is no ſtint beyond which ſuch diviſion may not be *ſuppoſed* to be continued; (for ſtill the laſt, how ſmall ſoever, will have two halves;) And, all thoſe Parts *were in* the Undivided whole; (elſe,where ſhould they be had?) 3. Of *ſuppoſed* Infinites,one may be *ſuppoſed* greater than another: As a, *ſuppoſed*,infinite number of *Men*,may be *ſuppoſed* to have a *Greater* number of eyes. 4. A ſurface, or ſolid, may be *ſuppoſed* ſo conſtituted, as to be *Infinitely Long*, but *Finitely Great*, (the Breadth continually Decreaſing in greater proportion than the Length Increaſeth,) and ſo as to have *no Center of Gravity*. Such is *Toricellio's Solidum Hyperbolicum acutum*; and others innumerable,diſcovered by Dr.*Wallis*,Monſieur *Fermat*,and others. But to determine this,requires more of *Geometry and Logick* than Mr.*Hobs* is Maſter of. 5. There may be *ſuppoſed* a number *Infinite*; that is, greater than any aſsignable Finite: As the *ſuppoſed* number of parts, ariſing from a *ſuppoſed* Section *Infinitely continued*. 6.There is therefore no reaſon,on this account, why the Doctrin of *Euclide*, *Cavallerius*, or Dr. *Wallis*, ſhould be rejected as of no uſe.

But having ſolved theſe *Quære's*, I have ſome for Mr. *Hobs* to anſwer, which will not ſo eaſily be diſpatched by him. For though *Suppoſed Infinites* will ſerve the Mathematicians well enough: yet, howſoever he pleaſe to prevaricate (which, he ſaith, is *for his Exerciſe*,) Mr.*Hobs* himſelf is more concerned than they,to ſolve ſuch *Quære's*. Let him ask himſelf therefore, if he be ſtill of opinion,that *there is no Argument in nature to prove, the World had a Beginning*: 1. Whether,in caſe it had not, there muſt not have paſſed an *Infinite number of years* before Mr. *Hobs* was born. (For,if but *Finite*,how many ſoever,it muſt have begun ſo many years before.) 2. Whether,now, there have not paſſed *more*; that is,*more than that infinite* number. 3. Whether, in that *Infinite* (or *more than infinite*) number of *Years*, there have not been a *Greater* number of *Days* and *Hours*: and, of which hitherto,*the laſt is given*. 4. Whether,if this be an Abſurdity, we have not then (contrary to what Mr. *Hobs* would perſwade us) an *Argument in nature* to prove,*the world had a beginning*. Nor are we beholden to Mr.*Hobs* for this Argument; for it was an Argument in uſe before Mr.*Hobs* was born. Nor can he ſerve himſelf (as the Mathematicians do) with *ſuppoſed Infinites*; For his Infinites, and more than Infinites of Years, Days, and Hours, *already paſt*, muſt be *Real Infinities*, and which have *actually exiſted*, and whereof the *laſt is given*; (and yet there are more to follow.) Mr. *Hobs* ſhall do well (for his Exerciſe) to ſolve *theſe*, before he propoſe more *Quære's* of *Infinites*. And this I ſay, to ſhew that Mr. *Hobs* is, as much as any, concerned to ſolve the *Quære's* by himſelf propoſed.

In the latter part of his firſt Paper,

He gives us (out of his *Roſet. Prop.* 5.) this Attempt of *Squaring the Circle*. *ſuppoſe* DT *be* $\frac{2}{5}$DC, *and* DR *a mean proportional between* DC *and* DT: *the Semidiameter* DC *will be equal to the Quadrantal Arc* RS, *and* DR *to* TV.

That the thing is falſe, is already ſhewed in the Latin Confutation of his *Roſetum*, publiſhed in the *Philoſophical Tranſactions* for *July* laſt paſt.

As it is now in the Engliſh; his Demonſtration is peccant in theſe words, (*Col.* 2. *lin.* 31, 32, 33.) *Therefore -- the Arc on* TV, *the Arc on* RS, *the Arc on* CA, *cannot be in continual proportion*; (with all that follows:) There being no ground for ſuch Conſequence.

And the thing is manifeſt *; for ſince that, by his conſtruction,
DC.CA.Arc on CA extended ∺
DR.RS.Arc on RS extended ∺
DT.TV.Arc on TV extended ∺
are *in the ſame cantinual proportion, of the Semidiameter to the Quadrantal Arc*;
Let that proportion be *what you will*; ſuppoſe, as 1 to 2; and conſequently, DC to CA being as 1 to 2, it will be to the Arc on CA, as 1 to 4: And by the ſame reaſon, DR to the Arc on RS, and DT to the Arc on TV, muſt alſo be as 1 to 4: And therefore the Arcs on TV, on RS, on CA; that is, 4 DT, 4 DR, 4 DC; will be in the ſame proportion to one another, as (their ſingles) DT, DR, DC: But theſe (by conſtruction) are in continual proportion; therefore thoſe Arcs alſo, as they ought to be. Indeed, if (by changing ſome one of the terms) you deſtroy (contrary to the Hypotheſis) the continual proportion of DT, DR, DC, you will deſtroy that of the Arcs alſo (which are ſtill proportional to theſe:) but ſo long as DT, DR, DC, be in *any* continual proportion

* See *Tab.* I. *n.* V.

portion (whether that by him aſsigned or any other) thoſe will be in the ſame continual proportion with them. As if for DT, DR, DC, be taken Dt, Dr, DC, in any continual proportion (greater, leſs, or equal to his) the Arcs on *tu*, on *rs*, on CA, (extended) will be in the ſame continual proportion.

But (which is the common fault of Mr. *Hobs*'s Demonſtration) if this Demonſtration were good, it would ſerve as well for any propoſition as that for which he brings it. For if, inſtead of $\frac{2}{5}$, he had ſaid, $\frac{4}{9}$, $\frac{1}{2}$, $\frac{1}{100}$, or what elſe he pleaſed; the Demonſtration had been juſt as good as now it is, without changing one ſyllable: That is, it will equally prove the proportion of the Semidiameter to the Quadrantal Arc, to be, *what you pleaſe*: As any may preſently ſee, who doth but read over his Paper.

In his ſecond Paper,

HE pretends to *confute a Theorem, which hath a long time paſſed for truth*; (and therefore doth no more concern Dr. *Wallis*, than other men.) And 'tis this, *The four ſides of a ſquare being divided into any number of equal parts, for example, into* 100; *and ſtreight lines drawn through the oppoſite points, which will divide the Squares into* 100 *leſſer Squares: The received opinion* (ſaith he) *and which* Dr. Wallis *commonly uſeth, is, that the Root of thoſe* 100, *namely* 10, *is the ſide of the whole Square.* Which to confute, he tells us, *The Root* 10 *is a number of Squares, whereof the whole contains* 100; *and therefore the Root of* 100 *Squares is* 10 *of thoſe Squares, and not the ſide of any Square; becauſe the ſide of a Square is not a Superficies, but a Line.*

For An.ſ I ſay, that 'tis neither the opinion of Doctor *Wallis*, nor (that I know) of any other (ſo far is it from being a *Received Opinion*, which Maſter *Hobs* inſinuates as ſuch) that 10 is the Root of 100 *Squares* (For ſurely a *Bare Number* cannot be the ſide of a *Square Figure*:) Nor yet (as Maſter *Hobs* would have it) that 10 *Squares* is the Root of 100 *Squares*: But that 10 *Lengths* is the Root of 100 *Squares*. 'Tis true that the *Number* 10 is the Root of the *Number* 100, but not, of a 100 *Squares*: and, that 10 *Squares* is the Root (not of 100 *Squares*, but) of 100 *Squared Squares*: Like as 10 *Douſen* is the Root, not of 100 *Douſen*, but of 100 *Douſen douſen*, or *Squares of a Douſen*. And, as, there,you muſt mnltiply not only 10 *into* 10,but *Douſen into Douſen*,to have the Square of 10 *Douſen*; ſo here 10 *into* 10 (which makes a 100) and *Length into Length* (which makes a *Square*) to obtain the Square of 10 *Lengths*, which is therefore 100 *Squares*, and 10 *Lengths* the Root or ſide of it. But,ſays he, the Root of 100 *Soldiers*,is 10 *Soldiers*. *Anſwer*. No ſuch matter: For 100 *Soldiers* is not the product of 10 *Soldiers into* 10 *Soldiers*, but of 10 *Soldiers into* the *Number* 10: And therefore neither 10,nor 10 *Soldiers*,the Root of it. So 10 *Lengths* into the *Number* 10,makes no Square, but 100 *Lengths*; but 10 *Lengths* into 10 *Lengths* makes (not 100 *Lengths*,but) 100 *Squares*.

So in all other proportions: As, if the number of *Lengths* in the *Square ſide* be 2; the number of *Squares* in the *Plain* will be *twice two*,(becauſe there will be *two* rows of *two* in a row:) If the number of *Lengths* in the *ſide*, be 3; the number of *Squares* in the *Plain*, will be 3 times 3, or the Square of 3: If that be 4,this will be 4 times 4: And ſo in all other proportions. Of which, if any one doubt he may believe his own eyes *.

* See *Tab.* I. *n.* VI. VII. VIII. IX.

And this Mr. *Hobs* might have been taught by the next Carpenter (that knows but how to meaſure a Foot of Board) who could have told him, that becauſe the *ſide* of a Square Foot, is 12 *Inches in* Length, the Plain of it will be 12 *times* 12 *Inches in Squares*: Becauſe there will be 12 Rows of 12 in a Row.

His third Paper,

WHich came out juſt as the Anſwer to the two former was going to the Preſs,contains,for ſubſtance,the ſame with his ſecond, and the Latter part of the firſt: And ſo needs no farther Anſwer.

Only I cannot but take notice of his uſual trade of contradicting himſelf.His ſecond Paper ſays,*The ſide of a Square is not a Superficies,but a* Line: His third ſays the quite contrary, (Prop. 1.) *A Square root, (ſpeaking of Quantity) is not a* Line, *but a Rectangle.* Other faults, falſities, and contradictions, there are a great many.

As for Inſtance: He tells us firſt, *In the natural Row of Numbers*, as 1, 2, 3, 4, 5, 6, &c. *every one is the Square of ſome number in the ſame Row*; (that is, of ſome Integer number;

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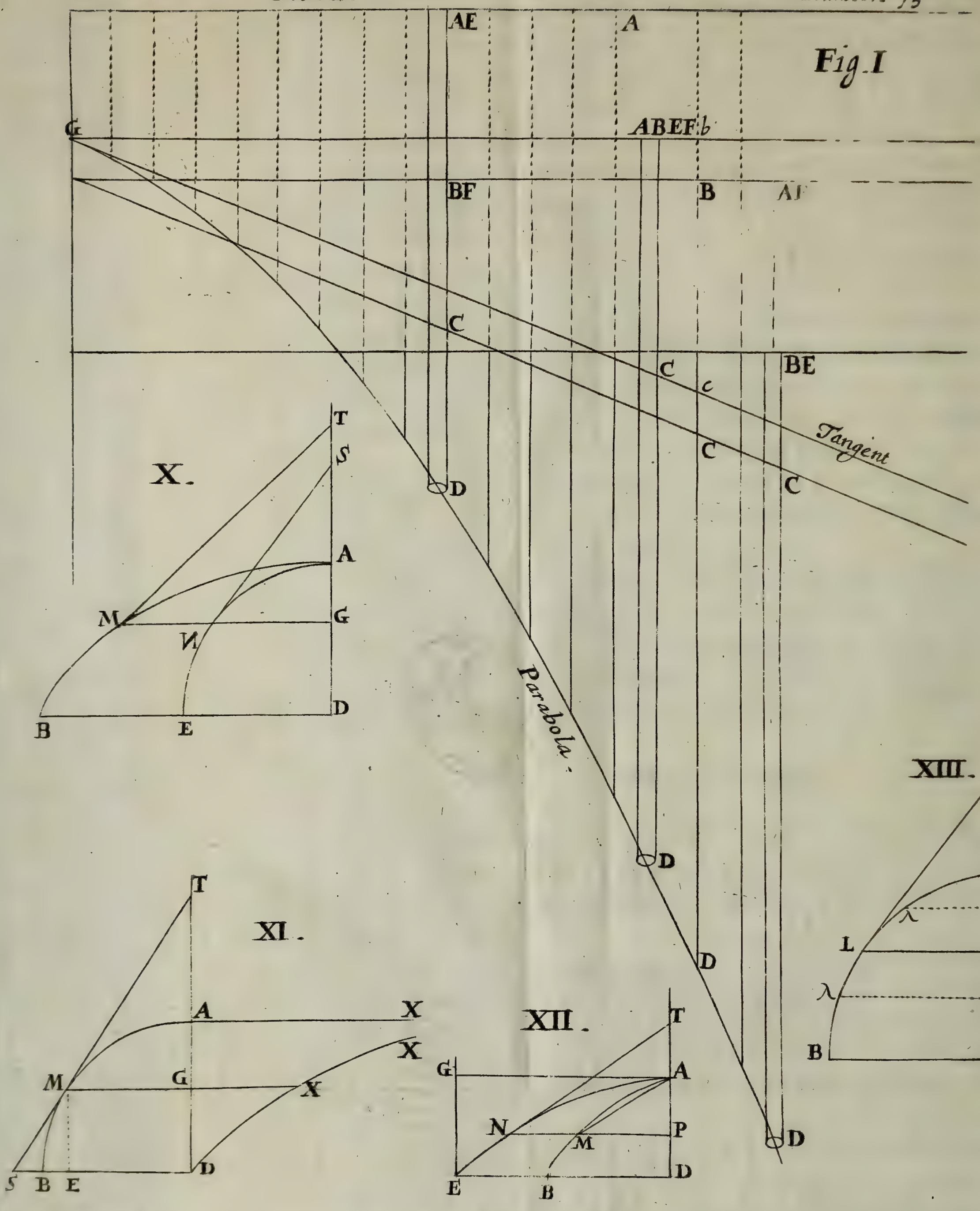
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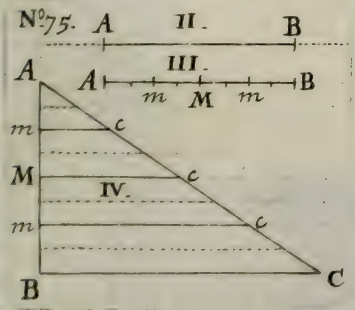
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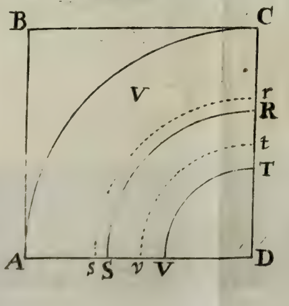
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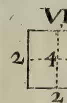
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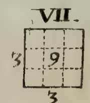
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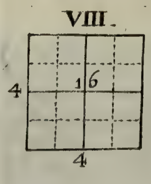
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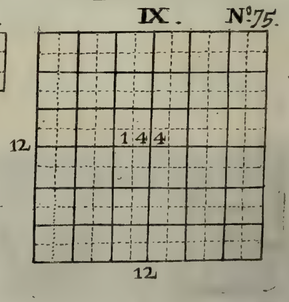

IX.
Nº 75.

which is notoriouſly falſe.) This he contradicts in the very next words, *But Square numbers (beginning at* 1*) intermit firſt two numbers, then four, then ſix, &c; ſo that none of the intermitted numbers is a Square number, nor hath any Square root.* (If theſe *intermitted numbers*, between 1, 4, 9, 16, &c. *be not Squares* how is it that *every one* in the whole row is a *Square*, and that of ſome Integer number?) But this again is contradicted *prop.* 2. where 200 (one of ſuch intermitted numbers) is made a *Square*, and $14\frac{4}{14}$ the *Root* of it.

Again; in his *Definition* he tells us, that *a Square Root multiplied into it ſelf produceth a Square:* But (*prop.* 2.) he multiplieth *the Root* $14\frac{4}{14}$ (not into it ſelf, but) into 14 (a part thereof,) to make 200, which he will have to be *the Square* of that Root. Nor is it a meer ſlip of negligence in the computation, but his Rule directs to it; *Any number given is produced by the greateſt Root multiplied into it ſelf, and into the remaining Fraction.* Whereof he gives this inſtance: *Let the number given be* 200 *Squares, the greateſt Root is* $14\frac{4}{14}$ *Squares* (he ſhould rather have ſaid *Lengths*; but that is a ſmall fault with him;) *I ſay, that* 200 *is equal to the product of* 14 *into it ſelf (which is* 196,) *together with* 14 *multiplied into* $\frac{4}{14}$ (*which is equal to* 4:) that is $14\frac{4}{14}$ multiplied into 14. But this calculation is again contradicted in his third propoſition, where he calculates *the ſame Square* otherwiſe, as we ſhall ſee by and by. In the mean time let's conſider this alone, and ſee the contradictions within it ſelf. His Rule bids us multiply *the greateſt Root into it ſelf*, &c. This *greateſt Root* he ſays is $14\frac{4}{14}$; yet doth he not multiply this, but 14 (a part thereof) *into it ſelf and into the Fraction* $\frac{4}{14}$. Again; if $14\frac{4}{14}$ be *the greateſt Root*, what ſhall be *the remaining Fraction*? Doth he take the Root of 200 to be more than $14\frac{4}{14}$ by ſome further *remaining Fraction*? If ſo, he ſhould have told us what that Fraction is; for $\frac{4}{14}$ it is not, this being part of his *greateſt Root* $14\frac{4}{14}$. But if we ſhould allow (as I think we muſt,) that by *the greateſt Root* he means ſometimes $14\frac{4}{14}$, ſometimes 14, (that is, if we allow him to contradict himſelf,) yet how comes he by the Fraction $\frac{4}{14}$? For, $\frac{2}{14}$ is too much (the ſquare of $14\frac{2}{14}$ being more then 200, as by multiplying $14\frac{2}{14}$ into it ſelf will appear;) which deſtroys his whole deſign; for 14, multiplied into $14\frac{2}{14}$, will not make 200, but 198; contrary to his rule. But further, it is ſo groſs a miſtake, to make 200 the Square of $14\frac{2}{14}$, that every Apprentice boy, (that can but multiply whole numbers, and fractions,) could have informed him better, who would firſt have reduced the fraction to ſmaller terms, putting $14\frac{2}{7}$ for $14\frac{4}{14}$, and then multiplying $14\frac{2}{7}$ into it ſelf, would have ſhew'd him, that the Square of $14\frac{4}{14}$, that is, $14\frac{4}{14}$ multiplied into it ſelf, is (not 200, but) $204\frac{4}{49}$.

But the Root of 200, is the ſaid number $10\sqrt{2}$, which is leſs than $14\frac{2}{14}$, and bigger than $14\frac{2}{15}$: the Square of that being ſomewhat more than 200; and, of this, ſomewhat leſs; but either of them within an unite of it.

$$\begin{array}{r} 14\frac{2}{7} \\ 14\frac{2}{7} \\ \hline 56 \\ 14 \\ 4 \\ 4 \\ \frac{4}{49} \\ \hline 204\frac{4}{49} \end{array}$$

But this ſecond Propoſition, is (as I ſaid) contradicted by his third, which makes the Square of $14\frac{4}{14}$ to be $200\frac{1}{49}$, (by what computation, we ſhall ſee by and by;) and then finds fault, that this and the former do not agree. (But 'tis no wonder they ſhould diſagree, when both are falſe.) *The ſame Square* (ſaith he) *calculated Geometrically, conſiſteth (by* **Euclid.** *2.4.) of the ſame numeral great Square 196, and of two Rectangles under the greateſt ſide 14 and the Remainder of the ſide, and further of the Square of the leſs ſegment; which altogether make* $200\frac{1}{49}$. (He might have learned to reckon better; but let us ſee how he makes it out.) *As by the operation it ſelf* (ſaith he) *appeareth thus: The ſide of the greater ſegment is* $14\frac{4}{14}$ (this was, but now, the ſide of the whole ſquare, how comes it now to be but the ſide of the greater Segment?) *which multiplied unto it ſelf* (ſaith he) makes 200: (no; but $204\frac{4}{49}$:) *The product of* 14 *the greateſt Segment into the two Fractions* $\frac{4}{14}$ is 4, *and that added to* 196 *makes* 200: (if by two fractions $\frac{4}{14}$, he mean, as he ought by his Rule, the Fraction 4 twice taken, or the double of it, it will be not 4, but 8, and this added to 196 make 204; But all this he puts in his pocket, for it comes not into account at all.) *Laſtly, the product of* $\frac{2}{14}$ *into* $\frac{2}{14}$, *or* $\frac{1}{7}$ *into* $\frac{1}{7}$ *is* $\frac{1}{49}$; which with the firſt 200 makes $200\frac{1}{49}$: (But he forgets himſelf, for his leſſer ſegment was not $\frac{2}{14}$, but $\frac{4}{14}$; he ſhould therefore have ſaid $\frac{4}{14}$ into $\frac{4}{14}$, or $\frac{2}{7}$ *into* $\frac{2}{7}$, is $\frac{4}{49}$.) His calculation therefore ſhould have been this: The greater ſegment is (not $14\frac{1}{14}$, but) 14; which multiplied into it ſelf makes (not 200, but 196: The Rectangle of the greater ſegment 14, into the leſſer $\frac{4}{14}$, is 4: And this taken a ſecond time, is another 4: The leſſer ſegment (not $\frac{2}{14}$, but) $\frac{4}{14}$, or $\frac{2}{7}$, multiplied into it ſelf, is (not $\frac{1}{49}$, but) $\frac{4}{49}$: All which added together make not 200$\frac{1}{49}$, but 196 + 4 + 4 + $\frac{4}{49}$ =) 204$\frac{4}{19}$, which is juſt the ſame with 14$\frac{4}{14}$ multiplied into it ſelf. So that, had he known how to multiply a number into a number, eſpecially when incumbred with fractions (which it is manifeſt he doth not,) he would have found no diſagreement between the *Arithmetical calculation*, and what he calls the *Geometrical*. But I am aſhamed (for him) that ſo great a pretender to ſuch high things in Geometry, ſhould be ſo miſerably ignorant of the common operations of practical Arithmetick.

His repeated Quadrature he now expreſſeth thus, *The Radius of a Circle is a mean Proportional between the Arc of a Quadrant and two fifths of the ſame.* But inſtead of *two fifths*, he might as well have ſaid the *half*, or *tenth*, or *hundredth part*, &c; or (taking T in DC produced beyond C,) the *double, decuple, centuple, &c.* or *what you pleaſe*: For his Demonſtration would have proved it, which is this. *Deſcribe a Square ABCD, and in it a Quadrant DCA. In the ſide DC* (continued if need be,) *take DT two fifths of DC*, (or its Half, Double, Hundredth part, or what you pleaſe;) *and between DC and DT a mean proportional DR; and deſcribe the Quadrantal Arcs RS, TV. I ſay, the Arc RS is equal to the ſtreight line DC. For ſeeing the proportion of DC to DT is duplicate of the proportion of DC to DR, it will be alſo duplicate of the Proportion of the Arc CA to the Arc RS, and likewiſe duplicate of the Proportion of the Arc RS to the Arc TV. Suppoſe ſome other Arc, leſs or greater than the Arc RS, to be equal to DC, as for example* rs; *Then the proprtion of the Arc* rs *to the ſtreight line DT will be duplicate of the proportion of RS to TV, or DR to DT, which is abſurd; becauſe Dr is by conſtruction greater or leſs than DR. Therefore the Arc RS is equal to the ſide DC; which was to be demonſtrated.* Which demonſtration therefore proving indifferently *every* proportion, doth not indeed prove *any*. In brief: The force of his Demonſtration is but this; *DT being to DC as* 2 *to* 5 (or in any other proportion) *and DR a mean proportional between them; RS will be ſo between TV and CA; and therefore* rs (*greater or leſs than RS,*) *will not be a mean proportional between TV and CA*: which is true; *but why it may not be equal to DC*, we have nothing but his word for it; there being nothing to ſhew, that *DC is equal to ſuch a mean proportional.* Again; though *rs* be not a mean proportional between TV and CA, yet it may be between *tv* and CA, which ſerves his Demonſtration as well;

which is indifferent to any three continual proportionals,as was ſhewed before.So that now we have had three Demonſtrations of this Quadrature,(in his *Roſetum*, in his *firſt* paper, and in his *third*,) and this common fault in all of them, that they equally prove the proportion by him propoſed, or any other what you pleaſe. But ſuch his Demonſtrations uſe to be.

And this is what I thought fit to ſay to Mr.*Hobs's Four Papers* (rather to ſatisfie the importunity of others, than becauſe I thought them worth Anſwering :) And ſubmit the whole,with all Reſpects, to the *Royal Society*, to whom Mr. *Hobs* makes his Appeal.

His Fourth Paper;

WHich came out ſince the *Three former* were anſwer'd, (containing ſome faint endeavors to re-aſſert ſome things in them,) is but meer Trifling, or worſe than ſo.

What he would therein inſinuate concerning *God* (that we may as well prove *Him* to have had a Beginning, as that the World had) ſmells too rank of Mr.*Hobs*. We are not to meaſure Gods *Permanent* Duration of Eternity, by our *ſucceſſive* Duration of Time : Nor,his Intire *Vbiquity*,by Corporeal *Extenſion*.

What in it concerns *Mathematicks*, (whether his own or others,)is ſo weak and trivial,(and ſaid only,that he may ſeem to ſay ſomething,though nothing to the purpſe,) that I ſhall truſt it with thoſe to whom he makes his appeal, without thinking it to need any Reply ; The view of what he writeth againſt, being a ſufficient Anſwer to all he ſaith.

New Obſervations of Spots *in the* Sun ; *made at the Royal Academy of* Paris,*the* 11,12 *and* 13*th of* Auguſt 1671 ; *and Engliſh't out of the French*,*as follows*.

IT is now about twenty * years ſince, that Aſtronomers have not ſeen any conſiderable *Spots* in the Sun,though before that time, ſince the Invention of Teleſcopes, they have from time to time obſerved them. The Sun appeared all that while with an entire brightneſs,and Signor *Caſſini* ſaw him ſo the *ninth* of this month of *Auguſt*.

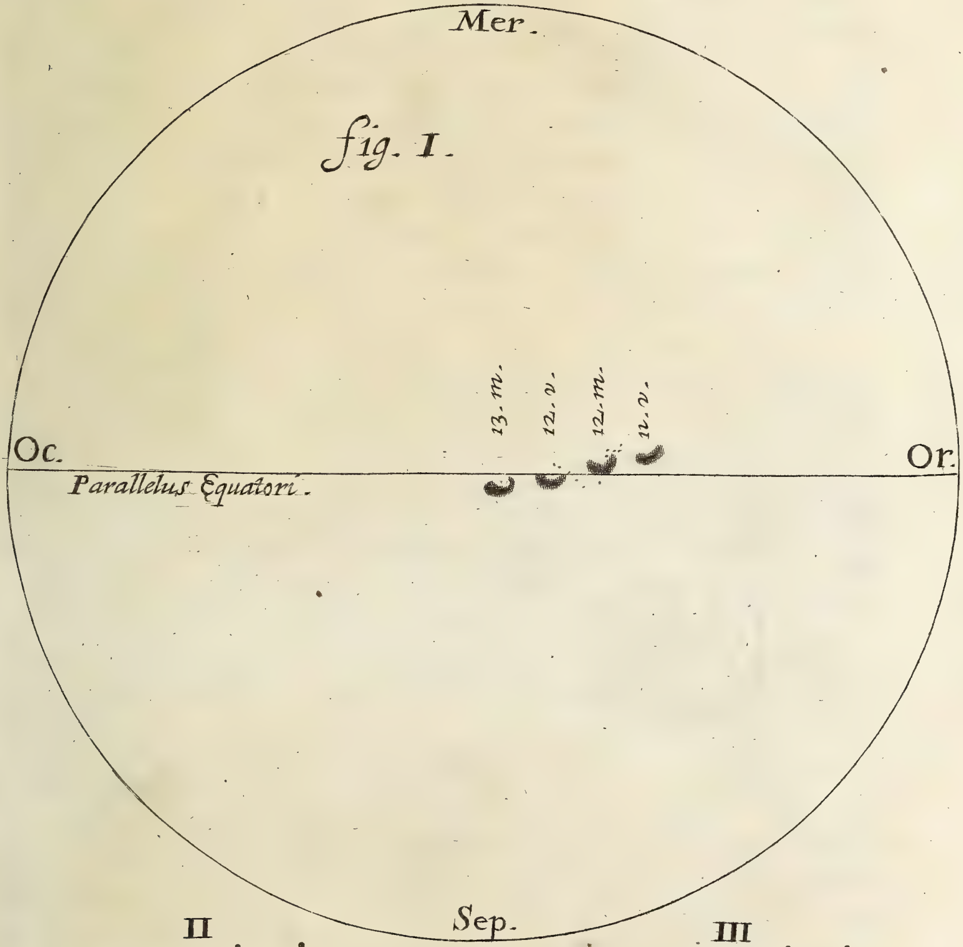
* *See* Numb.74.*p.* 2216 ; *whence it will appear* , *that ſome ſuch Spots were ſeen here in* London, *A.*1660. *And Monſ.* Picard *affirm'd to Dr.* Fogelius *at* Hamburg, *that he had ſeen ſome in* October 1661. *witneſs the ſaid* Doctor's *own Letter*, *written to the Publiſher* Auguſt 11th *laſt*.

But

Trans: N° 75.

Maculę in Sole die 11.12.et 13 Augusti 1671.

fig. I.



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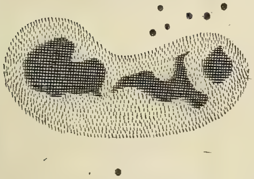

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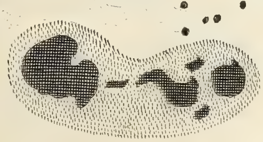

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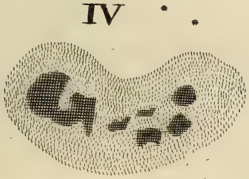
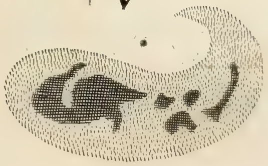


V



2251

BRITISH MUSEUM NATURAL HISTORY.

But the *Eleventh* of the ſame, about ſix a clock at night, being furniſht only with a three-foot glaſs, he remarked in the Sun's diſque *Two Spots* very dark, diſtant from his apparent Center about the third part of his Semi-diameter. And that he might the more exactly note their ſcituation, in reſpect of the ſeveral parts of the world, he made uſe of two very fine threds, cutting one another at right angles in the common *focus* of the two glaſſes and in the *Axis* of the Teleſcope: And having directed it toward the Sun, he ſo turn'd it, that letting it afterwards reſt, one might ſee the Center of the Sun, according to one of theſe threds, advance Weſtward, this ſame thred marking in the Sun a Circle parallel to the *Equator*; and the other thred marked the *Circle* of *Declination*; or the *Horary Circle* of the ſaid Sun. See *Tab.* II. *Fig.* I.

Then he obſerv'd, that the Spots were in the Southern part of the Sun; that their elongation from this parallel, paſſing through his Center, could be no more than about the *Sixtieth* part of his Diameter; and that they were ſcituate on the Eaſtern ſide in reſpect of the ſaid Center of the Sun. He alſo meaſur'd ſeveral times, from ſix a clock at night to ſeven, the time, which lapſed between the paſſage of the Sun's center, and that of the firſt of theſe Spots through the ſaid *horary Circle*, which ſometimes he found to be twenty three, ſometimes twenty two *ſeconds*, the ſemi-diameter of the Sun then paſſing in ſixty ſix ſeconds.

The firſt of theſe Spots, being look'd upon with a Teleſcope of ſeventeen foot long, appear'd of a ſomewhat Oval figure; the other was oblong and a little curv'd, like the Hebrew letter *Jod*; and both together were ſurrounded by a *corolla* or coronet made up of little dark points, which conformed it ſelf to the figure of the Spots, conſidered as they were joyned together: which coronet was more exactly obſerved the days following.

The *twelfth* of *Auguſt* he obſerv'd them from the time of Sun-riſing, and perceived that now they were nearer his Center. The time between the paſſage of the Suns center, and that of the interior edge of the Coronet which encompaſs'd them both, was then of ſixteen ſeconds. At ſeven a clock it was but of fifteen, and the Southern limb of the Coronet touched the parallel paſſing through the Sun's center.

He continued exactly to obſerve them with a great Teleſcope, from ſix a clock in the morning to ſeven, and found them to be there, as they are repreſented in the II *Figure* of *Tab.* 2. The firſt was compoſed of two others almoſt round, and conjoyned. The ſecond repreſented the ſhape of a Scorpion. The third was round. And they were all three environ'd with a Coronet, which was compos'd, as we ſaid above, of abundance of little obſcure pricks. This Coronet appear'd to be clearer than the reſt of the Sun when look'd upon with the ſhort Glaſs, and darker when ſeen with the long. Without it there were other points, but very black ones; *viz.* five near the round Spot on the South-ſide, and another near the Scorpion's tail on the North-ſide.

At Eight a clock and fourty eight minuts, the figure of the Scorpion was ſeen divided into ſeveral pieces, as if his tail and arms had been cut off; repreſented in the III *Figure* of *Tab.* 2. The Northern point appear'd no more, there remaining none but thoſe on the South-ſide; and the length of the encloſure of all the Spots, comprehended between the extremities, was of one minut and fifteen ſeconds, and the breadth of thirty ſeconds.

The ſame *twelfth* day, at ſix in the evening, he found no great change in the firſt Spot. The other two were ſever'd into five diſtinct ones, compaſs'd about with a Coronet, as appears in the IV *Figure* of *Tab.* 2. Together with five black points, which ſtood in a ſtreight row, and after another manner than they did in the morning. From ſix at night unto ſeven, the time between the paſſage of the Sun's center, and that of the Coronets limb, was found to be, one time, of *eight* ſeconds, and another time of *ſeven ſeconds* and an *half*. The diſtance of the Spots unto the parallel, paſſing through the Sun's center, was near the ſame on the North-ſide with what it had been obſerved to be in the morning on the South-ſide.

The *thirteenth* of *Auguſt*, between the Riſing of the Sun and half an hour paſt ſix in the morning, the Spots ſtood as is ſeen in the V *Figure* of *Tab.* 2; the edge of the Coronet, being turn'd to a point on the South-ſide, was diſtant from the *Equator*, on the North-ſide, half a minut; and there was but a ſecond of time from the paſſage of the Suns Center into the paſſage of the ſame anterior edge of the Coronet.

At eight a clock thirty minuts, the fore-edge was in the ſame *horary Circle* with the Center of the Sun: So that in one day and an half theſe Spots have run through very near the *third* part of the Sun's apparent ſemi-diameter, which giveth an Arc of nineteen degrees and an half of the Circumference of the Sun's Body; and conſequently their Diurnal motion about the Sun's *Axe* hath been of *thirteen* degrees; and the time of their Periodical revolution, as far as we could conjecture in ſo little time, muſt be about *twenty ſeven days* and *an half*: Which yet will be more exactly determined by Obſervations of a longer time. Mean while thoſe that have been made, give us hopes to ſee them yet ſix or ſeven days longer, if they diſappear not before they arrive to the Sun's limb.

We thought it not amiſs to advertiſe thoſe, that are addicted to Celeſtial Obſervations, of the Diſcovery of theſe *Phænomena*, that they may alſo obſerve the ſame; and if they be not furniſh't with great Teleſcopes, they ought not therefore to be diverted from it, ſince we have found, that by a glaſs of one foot theſe Spots may be ſeen, at leaſt as making but one ſpot. But it will be particularly neceſſary, to obſerve with care from about the fourth unto the eighteenth of the month of *September* next, (ſt.n.) whether theſe Spots, after they have paſſed over the Upper Hemi-ſpere of the Sun which is hid from us, will not return and be ſeen again in its apparent diſque.

So far the French Academiſts. To which we now add; 1. That ſince their Obſervations were made publick, we had notice ſent us from the above-mention'd Dr. *Fogelius* reſiding at *Hamburg*, (as we touched in the foregoing Tract,) that Mr. *Picard* had obſerv'd at Sea a Spot in the Sun from the third of *Auguſt* (ſt. n.) to the nineteenth of the ſame incluſively; and ſeen it, at the firſt, like the Tayl of a Scorpion; but on the nineteenth day reſembling a Melon-ſeed. 2. That ſeveral curious Obſervers at *London* have ſeen one of thoſe Spots recurr'd to the Sun's Eaſtern limb, on the ſame day that Signor *Caſſini* predicted in the Relation above deliver'd they ſhould return, if they continued: The particulars of whoſe Obſervations, if they come to hand, we may give an account of hereafter.

A Conſiderable Accompt touching Vegetable Excreſcencies, *given by that* Learned *and Obſerving Gentleman*, *Mr.* Martin Liſter, *in a Letter to the Publiſher, of* July 17. 1671. *from* York.

I Underſtand by yours of the 23*th* inſtant, that M. *Ray* cannot without much trouble retrieve the Letter, wherein I gave him formerly my opinion concerning *Vegetable Excreſcencies*; and yet not wholly to deny you the ſatisfaction of what you ſeem much to deſire, I am willing to think again upon the ſame ſubject, at leaſt to recollect part of my former thoughts, as my memory will ſerve me.

The occaſion then of that Letter was upon the account given us by You in *Numb.* 57, of the opinion of the Italian *F. Redi*; *Viz.* that ſome live Plants or their Excreſcencies do truly generate ſome Inſects. To which opinion of *F. Redi* I told my friend, as I remember, that I indeed had obſerved, that the By-fruits of ſome Vegetables, as of the *Oak* and *wild Roſe*, for example, did grow up together with their reſpective worms in them from ſmall beginnings to fair and large fruit, ſome of them emulating even the genuin off-ſpring of the plant,

——— *& miratur non ſua poma.*

And further, that I did believe, the worms were furniſhed with food in and from them; but not by any Navil-connexion, as that Author fancies, and which I ſaid, to me was unintelligible, and that I ſhould be glad of a notion, which might make out to me ſuch monſtrous relation, as half animal half vegetable, or which is all one, Vegetable veſſels inſerted into an animal, or, the contrary. Strange Oeconomy!

That it had never been my good fortune (what ever diligence I had uſed) to diſcern Eggs in the Center of *Galls*, but a worm conſtantly, even at the very firſt appearance, as near at leaſt as my fortune led me. Yet I would not deny, but that diligence might one day diſcover the egg it ſelf, which I was of opinion was affixed to or near the place by the parent-Inſect, where the Gall roſe.

That I ever found the worms in all the excreſcencies, that I had yet met with, perfectly at liberty; and for the filaments, our Author mentions, it was very poſſible he might be miſtaken, it being very hard, and a matter not yet treated of in any publick paper, which and what are the veſſels that enter into the Texture of a Vegetable, as of a large Tree, for example; much more hard would it be to ſay, this is a veſſel in a ſmall Gall. That there were many By-fruits of different figure and ſhape (though perhaps of a like Texture) upon one and the ſame plant, every one of which did nouriſh and produce a different race of Inſects: Whence, I told him, I thought might rather be argued the diverſe workmanſhip of different Inſects, then one and the ſame principle of vegetation to be Author of ſeveral ſorts of Animals.

That the Animals themſelves, produced of ſuch Excreſcencies, were for the kind of ſuch a race, as were well known to us to be otherwiſe generated of animal parents, and therefore it was probable, that theſe were ſo too, as well as their tribe-fellows.

That the Inſect-Animals produced of ſuch Excreſcencies were male and female; and that, if ſo, we might argue with *Ariſtotle* (lib. 1. c. 1. *de Generat. Animal.*) that Nature made not ſuch in vain, and that, if from the coit of theſe Animals, which have their birth from no Animals, Animals ſhould be born, they would *either* be like their parents and of the ſame ſpecies with them, and if ſo, it would neceſſarily follow (ſince in the generation of all other creatures it ſo comes to paſs) that their very parents had ſuch origin too: *or* unlike them, and if ſo (if theſe alſo were male and female) of this ſecond unlike off-ſpring a third race of different animals or *ſpecies* would be begot, and of them a fourth, and ſo *in infinitum*. And that theſe Inſects, which he and I had obſerved to be produced of the Excreſcencies of ſome vegetables, we had good cauſe to ſuſpect they were male and female, ſince ſome of them had ſtings and were tripilous, and others not (*vide Catalog. plant. Cantab. ad Roſam caninam & alibi.*)

Theſe were ſome at leaſt of the Arguments, as far as I remember, I uſed, when I formerly wrote on this ſubject to my friend; but ſince that Letter, I have peruſed the Book of *F. Redi* it ſelf, and do find, that the ſaid opinion is barely propoſed as a thing not unplauſible, but the proofs thereof are reſerved, till the publiſhing of a curious piece, concerning the *Excreſcencies* of the *Oak*; and therefore I ſhall be leſs earneſt in the refutation of that opinion, which perhaps a more accurate ſearch into Nature will in time make the Author of it himſelf find erroneous.

I preſume not to venture to decide this controverſy, my experience in theſe matters being too inſufficient, and my leiſure and health but little to haſten a convenient ſtock of particulars, and a due examination of them; yet before I leave this ſubject, I am willing to run over and preſent you with a few abbreviated inſtances of ſome of the ſeveral kinds of Vegetable Excreſcencies, and likewiſe ſome un-obvious ways of Inſects feeding on plants; and theſe I ſhall deliver in confirmation of the following Propoſitions.

1. That all are not truly Vegetable Excreſcencies that are reputed ſuch. And here we may juſtly name the *Purple-Kermes*, for example, whoſe hiſtory you were pleaſed to publiſh in *Numb.* 73. This, I ſay, both gives a clear light to the diſcovery of the nature of the *Scarlet-Kermes*, (a thing wholly unknown to the Ancients, as far as we can ſee by their writings, and no leſs ignored by the moderns,and yet , which is admirable, in very great eſteem and continued in uſe for ſome thouſands of years,) and alſo is an evident inſtance, that ſome things, confidently believed Vegetable Excreſcencies, are no ſuch matter, but Artificial things meerly contiguous to the plant, and which have no other relation to it than the *patella*-ſhellfiſh to the Rock it cleaves.

2. Generally, Inſect-Eggs laid upon the leaves of plants, or their reſpective worms feeding on them do not occaſion or raiſe Excreſcencies. This truth every body,that hath been the leaſt curious, is an Eye-witneſs of. Thus, for example, the Eggs of the common *Red butter-fly*, laid upon the Nettle, are thereon hatched without bliſtering the plant into an Excreſcence, and the ſtiff haired or prickly *Caterpillars* hatched from them Eggs, feed upon the leaves without any ill impreſſion, puncture, or prejudice, ſave that they make clean work, and eat all before them. I could produce ſome hundreds of inſtances,if this were to be doubted of.

3. Some Inſect-eggs, laid upon the leaves or other parts of plants, do, as ſoon as hatched, pierce and enter within the

plant to feed. To give you a convincing inſtance to the truth of this propoſition, take this from my notes.

May 22, I obſerved on the back or underſide of the leaves of *Atriplex olida*, certain ſmall milk-white oblong Eggs, on ſome leaves four, on others fewer, or more; theſe Eggs were on ſome plants yet unhatched, but on many of the ſame plants I found the Egg-ſhells or skins yet adhering to the leaves, and the little maggots already entered (through I know not what inviſible holes) within the two membranes of the leaf, and feeding on the inward pulp or ſubſtance of the leaf: in other leaves of that plant, (he that ſhall make the obſervation after me, will find plants enough of this *ſpecies* ſeized on, to vary, as I did, the obſervation in one day,) I found thoſe maggots grown very great, and yet the two membranes, that is, the uppermoſt and undermoſt skin of the leaf, entire, but raiſed and hollow like a blather. Note 1. That thoſe magots were of a Conick ſhape. 2. That in *July* they ſhrunk into *Fly Chryſalis's*, and accordingly came to perfection, &c. To this unobvious way of feeding we think we may refer all worm-eaten fruits, woods, &c.

4. Worms feeding within ſome of the parts of ſome plants do cauſe Excreſcencies. Thus the heads or ſeed-veſſels of *Papaver. Spart. Sylv. Ger. Emac.* &c. are disfigured for having worms in them, and grow thrice as big, as the not ſeaſed ones. This is alſo plain in the Excreſc. of *Pſeudo teucrium*, and *Barbarea*, &c.

5. The ſubſtance of moſt Vegetable Excreſcencies is not the food of the worms to be found in them. The inſtances given in confirmation of the laſt propoſition do alſo confirm this: neither is an *Oak-apple* properly worm-eaten, or the *Shagged Galls*, or *Sponges* of the *Wild Roſe*, or the *Smooth* ones on the leaves of the ſame plant, or the Baggs upon the leaves of the *yellow dwarf Willow* or the *Elm*, &c.

This is the ſum of what I have to ſay at preſent concerning this ſubject, being very unwilling to advance further, than my own private obſervations will ſuffer me.

An Accompt of ſome Books.

I. *Lectiones* 18, Cantabrigiæ *in Scholis publicis habitæ, in quibus OPTICORUM Phænomenων Genuinæ rationes inveſtigantur & exponuntur, ab* Iſaaco Barrow, *Coll.S.*Trin.*Socio, Matheſ. Profeſſ.*Lucaſiano,*&* Soc. Regiæ *Sodali.* Londini, 1669. *in* 4°. *Impenſis* Joh.Dunſmore *ad Inſigne Roſæ & Coronæ, in Cæmeterio D.* Pauli.

A Brief ſummary of theſe *Optick Lectures* the Excellent Author doth himſelf deliver in an Epiſtle to a Friend, who deſired ſuch an one from him; when he ſaith, that in them he endeavoureth to promote that part of *Opticks*, which he undertakes to treat upon, firſt by explaining and eſtabliſhing its Principles; then by deriving from them ſome uſeful Conſectaries, ſerving to the explication of the *Phænomena*: in the mean while attempting to correct ſome common errours, and to ſupply ſome principal defects therein.

Towards theſe purpoſes, he firſt examineth the received *Hypotheſes* of this Science, ſhewing, how they ſhould be underſtood, and how far admitted; aſſigning alſo ſome *Phyſical* cauſes of them, (in the performance whereof he declares himſelf not to confide much, but only requires the *Hypotheſes* themſelves, as not diſagreeable to Reaſon, and very congruous to Experience, to be admitted.)

Having firſt ſetled the *Hypotheſes*, he firſt draweth from them ſome general Corollaries, partly before acknowledged by others, and partly obſerved by himſelf; all confirmed by his own demonſtrations.

Then proceeding to more Special matters, he proſecutes diſtinctly *Catoptricks* and *Dioptricks*, both *Plain* and *Spherical*. And ſlightly paſſing over *Plain Catoptricks* (as eaſy and commonly treated on, truly enough,) he more largely inſiſts upon *Spherical Catoptricks*, propounding ſuch Theorems, whereby the Interſections, and the Limits of Reflected rays are declared, and together the Appearing places, or images of points radiating both from a great (and, as it were, immenſe) diſtance, and from a diſtance ſenſibly near, are determined, both in reſpect of an eye placed *in* the Axis of the radiation, and in reſpect to one placed *without* that Axis any where; the which particulars he had not obſerved in any Book extant to be truly and diligently handled.

Then he from the foundation raiſeth a *Theory* concerning both *Plain* and *Spherical Dioptricks*, aſſuming for a ground that rule concerning the Meaſure of Refractions, which Mr. *Des-Cartes* firſt diſcovered, and which now moſt of the beſt writers do admit, and which he judgeth agreeable to truth (for that all deductions from it very well ſuit to experience) which yet he knows not that any writers have applyed to this purpoſe, ſo as to have raiſed any competent ſuperſtructure thereon. And here orderly (firſt in reſpect to *Plain*, then to *Spherical Surfaces*,) conſidering points radiating from a diſtance ſo great that their rays may be ſuppoſed to fall parallel to one another upon the refracting ſurface, he propounds ſome *Theorems*, from which the chief Symptoms of refracted rays do reſult; their Interjections and Limits are eaſily diſcernable; the appearing places or images of ſuch points are defined, both in regard to an eye ſituated *in* the Axis of the radiation, and in regard to one placed *elſewhere*. Then he proſecutes in like manner the ſame things in reſpect to *Points*, radiating from a diſtance ſenſibly finite or near.

And that the *Uſe* of theſe things may be more ready, and ſerviceable to practiſe, he ſubjoyneth diſtinctly and particularly the determinations of the places in the Axis of the Images of points however radiating through each kind of *lentes*.

Having diſpatched theſe matters, he toucheth generally concerning the making a judgment about the Appearances of Magnitudes (as to their ſcituation and figure,) which follow thoſe ſorts of reflection and refraction: Afterward more ſpecially and copiouſly, he ſhews what kind of Images plain objects do yeild from ſuch reflections, and how they may be delineated.

Among theſe things there are interſperſed ſome conſiderations about divers incident matters, as about the nature of Light, and the cauſes of different Colours about the Rainbow, or colours appearing in pellucid globes; about ſome appearances in the vitreous *Priſme*; concerning the *linea refractaria*, concerning the reſolution of problems by Appropriate lines; concerning the properties of the *Conical* ſections in the reflection of lucid rays, &c.

II. *Lectiones*

II. *Lectiones* 13. *GEOMETRICÆ,in quibus (præſertim) Generalia LINEARUM CURVARUM Symptomata declarantur ab eodem* Iſaaco Barrow,*&c. Impenſis ejuſdem Bibliopolæ,in* 4°.

Concerning the *Geometrical Lectures*, arguing great depth in the Mathematical Learning,

In the *firſt* of them, in order to what follows afterward concerning the *Generation of Magnitudes*, the Deſerving Author treateth about the Nature of *Time*, as it may be conſidered in Mathematical ſuppoſitions about ſuch Generations.

In the *ſecond* are declared the Mathematical *Hypotheſes* about ſimple Motions (progreſſive and Circular,) which ſerve to the Production of Magnitudes, together with ſome general remarks, about the natures, dimenſions, and properties (conſequent on ſuch productions) of Magnitudes. There is alſo a touch about the Method of *Indiviſibles*, explicating, how in ſome caſes it is to be underſtood and applyed.

The *third* treats about the Generation of Magnitudes by compoſition and concourſe of motions.

In the *fourth* and *fifth*, from one generation propounded of Curve lines, (ſuppoſing them produced by two motions, one uniform,the other accelerated) divers Theorems are inferr'd, implying ſo many general properties of Curve lines.

The next *five* Lectures do contain many Theorems, and Problems about readily determining the *Tangents* of *Curve* Lines,immediatly by them, without other computation; particularly, there are divers ſingle Theorems, whereby the Tangents of all Curves commonly known or conſidered in Geometry (the *Conical Sections*, *Conchoids*, *Ciſſoids*, *Spirals*, *Quadratrices*, &c.) are determined in ways ſo general,as to comprehend alſo the like determination of Tangents in regard to innumerable other Curves,generated in a common manner with them. Of thoſe five Lectures the two firſt are *Lemmatical*, or preparatory to the Demonſtration of the propoſitions delivered in the other three; wherein yet there be ſome *Theorems* not unpleaſant. In the *tenth* is delivered a general Analytical method of determining Tangents,extending to all ſorts of Curve lines, both *Geometrical* and *Mechanical* (as Monſieur *Des-Cartes* diſtinguiſheth.)

The *eleventh* Lecture containeth ſeveral general Theorems, about the Dimenſion of Magnitudes, or the compariſon of them with one another.

To that there is ſubjoyned an *Appendix* concerning the dimenſion of Circular, and Hyperbolical ſegments, with divers Theorems and Rules ſerving to that purpoſe.

The *twelfth* Lecture containeth alſo ſeveral Theorems concerning the Dimenſion of Magnitudes, but chiefly reſpecting the dimenſion of Surfaces produced by the Rotation of Curve lines, and the dimenſion of Curve lines themſelves.

To this Lecture there are alſo three Additaments; the *firſt* whereof containeth ſome Theorems about the dimenſions of Spaces conſtituted by the Tangents and Secants of a Circle. The *ſecond* ſhews, how the foregoing Theorems may be demonſtrated by the Apagogick way, or by reduction *ad abſurdum*; together with a way of finding the dimenſion of the ſurfaces of Conical bodies. In the *third* divers Problems and Theorems are added, of kin to thoſe of the *eleventh* and *twelfth* Lecture.

The *thirteenth* Lecture propounds an Explication of the nature, and conſtitution of Equations, together with the variety of Roots, their Limits, &c. by conſtruction, and conſideration of certain curve lines appropriate to each Equation: with ſome notes reſpecting each particularly, and all in general.

So much of theſe two Excellent Treatiſes: Since the Publication of which, their worthy Author hath been pleaſed to communicate to a Friend of his ſome Corollaries, belonging to the ſecond *Problem* of his third *Appendix* to the twelfth *Lecture*; which becauſe we conceive they will be very acceptable to the Mathematical Reader, we ſhall here, by the Author's good leave, ſubjoyn them in the ſame Language, he hath written them in, *viz.*

Cæterum, ἐπιμέτρου *vice, animadverto, potuiſſe ſecundo Appendiculæ tertiæ Lectionis XII. Problemati Corollaria quædam adponi non injucunda; qualium adſcribam unum & alterum.*

Probl. 1. *Detur linea quæpiam AMB (cujus axis AD, baſis DB,) curva ANE deſignetur talis, ut ductâ libere rectâ MNG ad BD parallela, quæ ipſam ANE ſecet in N; ſit curva AN æqualis ipſi GM.* V. Tab. 1. n X.

Curva ANE talis ſit, ut ſi MT curvam AMB, & NS curvam ANE tongant, ſit $SG.\ GN :: TG.\ \surd GMq - TGq$; *ipſa ANE propoſito faciet ſatis.*

Probl. 2. *Iiſdem quoad cætera ſuppoſitis, & conſtitutis; curva*

ANE jam talis eſſe debeat, ut curva AN ſemper æquetur interceptæ rectæ NM.

Curva ANE jam talis ſit, ut ſit SG. GN :: 2TG × GM. GMq — SGq; erit ANE curva, quæ deſideratur. V. fig. eandem.

Probl. 3. *Datur curva quæpiam DXX, cujus axis DA; reperiatur curva AMB proprietate talis, ut ſi libere ducatur recta GXM ad ipſam AD perpendicularis, ponaturque, SMT curvam AM tangere; ſit MS æqualis ipſi GX.*

V. *Tab.* 1. *n.* XI.

Liquet rationem TG ad TM (hoc eſt, rationem GD ad MS, vel GX,) dari; adeoque rationem TG ad GM quoque dari.

Inſervit hoc ſuperficiebus deſignandis, quarum in promptu ſit dimenſio. Etenim (ductâ ME ad AD parallelâ) ſuperficies Solidi, ex Plani BME circa axem DB rotatu progeniti, adæquat $\frac{\text{Periph.}}{\text{Rad.}}$ *GDX; ut habetur in 11ª Lectionis XII.*

In Lect. XI. Appendice, numero 33, *de* Cycloide *profertur Theorema quoddam; id quod ex hujuſmodi generaliori Theoremate deduci potuiſſet.*

Sit AMB curva quælibet, cujus axis AD, baſis DB; ſit item curva ANE talis, ut ſi arbitrariè ducatur PMN ad DBE parallela, poſitóque, rectam TN curvam ANE tangere, ſit TN parallela ſubtenſæ AM; completo rectangulo ADEG, erit ſpatium trilineum AEG æquale ſegmento ADB.

V. *Tab.* 1. *n.* XII.

Huic ſuppar theorema tale eſt: Iiſdem poſitis; ſi tam ſegmentum ADB, quàm ſpatium AEG circa axem convertantur; erit productum è ſegmento ADB ſolidum producti ex AEG duplum. V. fig. eand.

E Tangentium *porrò contemplatione ſuborta eſt methodus, per quam expeditiſſime plurima circa maximas quantitates Theoremata deducuntur; quæ certè, ſi tempeſtivè ſe objeciſſent, digna cenſuiſſem quæ* Lectionibus *infererentur: ex iis indigitabo nonnulla.*

Sit curva quæpiam ALB, cujus axis AD, baſis DB, & huic parallelæ LG, λγ; item LT curvam tangat:

V. *Tab.* 1. *n* XIII.

Theor. 1. *Sit* m *numerus quicunque* poteſtates *exponens; ſi ponatur* $DG^{\underline{m-1}} \times TG = GL^{\underline{m}}$; *erit* $DG^{\underline{m}} + GL^{\underline{m}}$ *maximum, ſeu majus quàm* $D\gamma^{\underline{m}} + \gamma\lambda^{\underline{m}}$.

Th. 2. *Itidem ſumpto numero* m, *ſi ponatur* $BL^{\underline{m-1}} \times TL = GL^{\underline{m}}$; *erit* $GL^{\underline{m}} + BL^{\underline{m}}$ *maximum, ſeu majus quàm* $\gamma\lambda^{\underline{m}} + B\lambda^{\underline{m}}$.

Th. 3. *Sint numeri quilibet* m, n; *ſi ponatur* $m \times TG = n \times DG$, *erit* $DG^{\underline{m}} \times GL^{\underline{n}}$ *maximum, ſeu majus quàm* $D\gamma^{\underline{m}} \times \gamma\lambda^{\underline{n}}$.

Th. 4. *Quòd ſi ponatur* $m \times TL = n \times$ *arc* BL, *erit* $GL^{\underline{n}} \times BL^{\underline{m}}$ *maximum, ſeu majus quàm* $\gamma\lambda^{\underline{n}} \times B\lambda^{\underline{m}}$.

Th. 5. *Si fuerit* $TG \times GL = DGLB$, *erit* $DGLB \times GL$ *maximum, ſeu majus quàm* $D\gamma\lambda B \times \gamma\lambda$.

Th. 6. *Sin* $TG \times GL = 2\,DGLB$, *erit* $GL \times \surd DGLB$ *maximum, ſeu majus quàm* $\gamma\lambda \times \surd D\gamma\lambda B$.

Haud difficili negotio cùm hæc demonſtrantur, tum ejuſmodi complura deprehenduntur.

III. *A Continuation of the MEMOIRES of M.* Bernier *concerning the Empire of the G.* Mogol. *Engliſh't out of French.* London, *Printed for* Moſes Pitt *in Little Brittain,* 1671. *in* 8o.

THe *firſt* Volume of theſe *Memoires*, lately alſo printed in *Engliſh* for the ſame Bookſeller, containing almoſt nothing but *political* affairs, was left un-mention'd in theſe Books; but this *ſecond* taking notice of many particulars, relating to our deſign, we thought good to give it ſome place here; and to let the Reader know, that, beſides an accurate Deſcription of the two famous Cities of Indoſtan, *Dehli* and *Agra*, and many things diſcovering the *Genius* of the *Mogols* and *Indians*, as alſo thoſe, which belong to their *militia*, &c. here is an account given,

Firſt, of the Extravagant opinions of the Gentiles of *Indoſtan*; of their odd belief concerning *Eclipſes*; of the Books of Sciences received amongſt them; of their Doctrine of the Tranſmigration of Souls, and of the Creation, Preſervation and Deſtruction of the World; as alſo a Relation of the different Sects of Philoſophers amongſt them; of their Method of *Phyſick*, very different from ours, and how ſucceſsful; of their ignorance in, and averſion from *Anatomy*; of their pleaſant Tenets in *Aſtronomy*, *Geography*, and *Chronology*; of their opinion concerning *Plants* and *Animals*, importing that the Seeds of both of theſe kinds are not form'd anew, but were contrived in the Firſt production of the World; as alſo, that they are actually the very entire Plant or Animal.

Secondly, here is to be found a good deſcription of the kingdom of *Kachemire*, the reputed *Paradiſe* of the Eaſt-Indies; its antient State; its preſent condition and excellencies for Soyl, Vegetables, Waters, Cattel, Wild Dear; the wit and Induſtry of the Inhabitants in making fine ſtuffs, good Verniſh, &c. the condition of its Mountains, one ſide of them being intolerably hot, and yielding *Indian* Plants, the other very tolerable, and affording

fording none but *European* Plants; ſome remarkables about the Generation and Corruption of Trees there; ſtrange *Caſcata's* of water; a rare fountain,flowing,and ſtopping regularly thrice a day, at a certain time of the year, and at other times flowing irregularly; and a great Lake,having Ice in Summer,&c. The Scituation of the kingdoms of *Tibet*, and the Commodities they offord. A conſiderable account of Voyages made by Caravans from *Kachemire* through the mountains of the great *Tibet* into *Tartary* and *Cataja*; and another,of the kingdom of *Kacheguer*, with directions how to travel thither from *Kachemire*,as alſo,how to paſs from *Kacheguer* to *Cataja*. To all which is added an Anſwer to ſome Queſtions touching the *Mounſons* and *Rains* in *India*; the wonderful regularity of the Current of the Sea, and of the Winds there; the fertility of *Bengale*; and the Cauſes of the Inundation of the *Nile* and ſome other Rivers. The whole is concluded with a Letter concerning the Doctrine of *Atoms* and the nature of the *Mind* of Man.

Hiſtoria & Meteorologia INCENDII ÆTNÆI, *Anni* 1669. Joh.Alph.Borelli. *Regio Julio* 1670. *in* 4°.

THough we have ſeen ſeveral Relations communicated to us of this late fire Fire of Mount *Ætna*,one of which hath been inſerted in *Numb.*51.of thoſe Tracts; yet will it be eaſily allow'd by thoſe, that ſhall have read and conſidered this Diſcourſe,compoſed and publiſhed by the famous Philoſopher and Mathematician *J. Alph.Borelli*,that all others, that have hitherto written any thing about it, muſt needs give the preemince to him in reſpect of method,fulneſs, and philoſophical reflexions; to the performance of which he averreth to have been induced by his Eminence the Cardinal *de Medicis* and the Engliſh *R. Society*.

The Author then having given a ſhort *Topography* of this Mountain,delivers firſt a ſuccinct Relation both of the old and later Eruptions, as alſo of this laſt Fire of *Ætna*, and withall aſſigneth the *perpendicular* Height of the ſame, ſhewing it not to exceed three *Italian* miles,and here taking notice of *Kepler's* aſſigning two ſuch miles for the height of the Atmoſphere, and thence concluding the top of *Ætna* to be conſiderably raiſed above that region of the common Air; confirming the ſame by a known Experience, whereby thoſe that are on the ſaid top at a clear break of day, may plainly ſee the whole Iſland of *Sicily*, and all the Towns thereof, as 'twere elevated and hanging in the Air, near the Eye, juſt as, upon the account of Refraction, ſtones lying at the bottom of a pond appear nigh the ſurface of the water.

After this, in the Hiſtory it ſelf of this Eruption he deſcribeth particularly;

Firſt, the beginning of it, which happen'd on the 8th of *March* 1669, accompanied with Earth-quakes, and a Rent of the ground of 12 miles long, and 5 or 6 foot broad, as alſo with a terrible noiſe, roaring and cracking, vaſt globes of ſmoak firſt riſing into the Air, and abundance of fiery melted ſtones being ejected ſoon after, which firſt ran like a flood of fire, and overwhelmed in a ſhort ſpace of time 13 towns, beſides a part of the City of *Catania* it ſelf, and afterwards were by the Air hardned into vaſt heaps of black and pumice-like ſtones, there call'd *Sciarra*; waſting and ſpoiling abundance of Vines, Olives, and other plants.

The caſting out of the Aſhes and Sand continued for three whole months without ceaſing, and filled all the neighbouring country, and cover'd all the Trees thereof for 15 miles about; the ſmalleſt duſt flying even over Sea into *Calabria* by a South-wind, and into the moſt Southern-parts of *Sicily* by a North-wind.

But then on the 25th of *March*, by a new Earth-quake the Top or Turret of Mount *Ætna* it ſelf fell in, whereby was made an Opening or Cauldron of three miles in compaſs, and vaſt quantities of new matter caſt out, and amongſt it, abundance of fiery ſand, falling down with a yet burning heat at 8 miles diſtance from the Cauldron; whereupon the ſame by particular view and obſervation was found widen'd to the circumference of 6 miles. Mean while all conſidering men there were amaz'd at the force throwing out to ſo great a height ſuch huge ſtones, whereof one was meaſur'd to be 60 palmes (or about 40 foot) long, which was faln down a mile from the Cauldron with that violence, that it was ſtruck 30 palmes into the ground.

When this fiery Torrent aſſaulted *Catania* it ſelf, and had already by its impetuoſity forced from its place a whole hillock, planted with vines, belonging to the *Jeſuits*, and carryed them floating, together with the ſoil bearing them, till it ſo ſwelled as to cover and ſink them all; there appear'd ſome gallant perſons, who by their ingenuity and extraordinrry diligence, with fit Inſtruments, and raiſing vaſt ſtrong walls, diverted the courſe of the fiery ſtream from that City, but chiefly by boaring through the ſtony heaps, and thereby making paſſage for that current another way, and turning part of it into the Sea, wherein it made a promontory of a mile's compaſs before the Town.

It ceaſed by the 11th of *July* of the ſame year it began: And in *May* of 1670. our Author himſelf could handle without hurt the inner parts of the Cauldron and the former Torrent, and ſaw not ſo much as any ſmoak remaining in the higheſt part of that opening: Where yet he obſerveth, that notwithwanding this entire ceaſing in the ſaid places, there were yet found in ſeveral parts of this newly ejected *Sciarra* hot and ſtrong-ſmelling fumes ariſing on high, eſpecially near the walls of the South-ſide of *Catania*, where wells had been digged for watering their Garden-fields.

This being the Breviat of the Hiſtory of this Eruption, which the Author deſcribeth with many other conſiderable circumſtances; we proceed to acquaint the Reader, that after this Deſcription he expatiateth into divers important ſpeculations and remarks thereupon.

And *firſt* he comments upon the Form, Conſiſtence, Bulk, and Motion of the ejected matter; taking particular notice of the great abundance of *Sal Armoniac*, that was found in all the holes and vents of the ground, and in the clefts of ſtones; and obſerving, that in three months time the fiery flood ran out 12 miles in length, and, taking the *medium*, one mile and two thirds of a mile in breadth, and ſtopp'd at laſt by the ceaſing of new matter, and the condenſation of the liquid matter by the cooling Air.

Next, he compareth together the meaſure of the freſhly ejected matter with that of the Mountain, and finds it to equal near a fourteen thouſand part of the whole Mount.

Thirdly, he evinceth, that Mount Ætna hath no ſuch vaſt deep cavities, as ſome imagine, within its bowels near the ſurface of the Sea, but that there it is filled up with ſolid and ſtony matter, the huge weight of the ſuperincumbent hill rather compreſſing it, than ſuffering any conſiderable hollowneſſes to continue therein.

Fourthly, having exploded the imperfect *Meteorology*, deliver'd by the Antients of this Mountain, he diſcourſeth of Subterraneous Heat, and deduceth the Cauſe of it from ſome concrete oleaginous and fatty ſubſtances, as ſulphur, bitumen, and oyl, eaſily reducible into flame; examining withall, both what is the origin of ſuch ſulphureous and bituminous matter, and how that comes to take flame: Where he digreſſeth to ſhew, how Gunpowder is ſet on fire, after he hath deſcribed the compoſition, and conſidered the ſtupendious force of the ſame by its percuſſion.

Fifthly, he declareth, how and why the Fire in this Mountain was kindled; which he conceiveth to have been moſt probably done by ſuch a way, as Quick-lime is heated by the affuſion of Water; whereupon he ſheweth, how Earth-quakes, Flames, and Conflagrations may have enſued.

Sixthly, he examins the origin and production of the fluid matter that was vitrified upon its being thrown out of this Mountain; and is of opinion (which he aſſerts by reaſon and experiment) that it was not any ignited and melted Sulphur or Brimſtone, or both together, nor any metallin bodies that were converted into thoſe vaſt ſtony and black maſſes, which they call *Sciarra's*, but rather Earth and Sand, together with ſome Alcaliſat Salts, burn'd by the fervent heat of the *Ætnean* furnaces, and ſo turn'd into a vitreous fluor, and afterwards, upon their being cool'd by the Air, into hard ſubſtances: Explaining withall, how the Aſperity and Opacity of theſe ſtones are conſiſtent with this ſentiment.

Seventhly, he diſcourſeth plauſibly of the Extent, Form and Scite of the *Ætnean* Furnace, and having, upon the examination of divers circumſtances, found it but ſmall and narrow, he labours to ſhew, how, this notwithſtanding, ſo vaſt a quantity of matter, as amounts, according to his eſtimate, to about 100, 000, 000 cubic paces, could be therein melted and thence caſt up.

Eightly, he deſcribeth the burning down and falling in of the higheſt top of *Ætna*.

Ninthly, he inquireth into the Generation of thoſe *Sands* abovementioned, and withall giveth an account, why in the New opening of *Ætna* there were heard ſuch terrible and perpetual Thundering noiſes, as alſo, by what cauſe and force thoſe Sands were thrown out; ſhewing withall, that they were really *Sands*, not *Aſhes*, and ſolving Objections alledged againſt it.

Tenthly, he concludeth, that ſince, by his calculation, the upper part of Mount *Ætna* hath been juſt ſo much depreſſed, as the maſs of ſand and ſtones ejected amounts to, this maſs was furniſh't by the Mountain it ſelf, and from the Earth and Sands thereof produced and vitrified: where he taketh pains to make it appear, how all that prodigious quantity of matter, thrown out both now and in former ages, and ſeeming far to exceed the bulk of this whole Mountain, could be furniſh't by *Ætna* it ſelf, and yet the ſame not be quite levelled with the ground: The like of which he conſiders of Mount *Veſuvius*.

Eleventhly, he taketh particular notice, that, whereas the Fires were ſoon extinguiſh't in the place of the very Pit of the Sulphur and Bitumen, yet they laſted long in other places, that were wateriſh and deſtitute of combuſtible fatneſs; endeavouring to render a reaſon of this *phænomenon*.

Twelfthly, he inſerts an Obſervation of great plenty of *Sal Armoniac*, caſt out in this *Incendium*, which, he ſaith, was ſeen adhering both to the corners and aſperities of the *Sciarra*, and to the ſides of the rents made in thoſe huge ſtones, which the ejected matter was at length hardned into. And of this Salt he affirms, that there had been ſublimed, (for he makes it *factitious*) ſo great ſtore, that many thouſands of pounds might be gather'd; adding, that even a whole year after the extinction of the Fire in the Mouth's of *Ætna*, there were found remaining divers vents about *Catania*, exhaling ſtore of ſmoak, which had the like Sal Armoniac ſticking to the ſides and edges of the Stones.

Laſtly, he rejecteth the opinion of thoſe, that will maintain the Ætnean Fires to have been perpetual and never extinguiſh'd, aſſerting the frequent ceſſation of them, and withall aſſigning the cauſe of that ceſſation, as well as that of their renovation. Concerning which, and many other conſiderable remarks and reflections, too many to be here recited, we refer the Reader to the Book it ſelf.

An Advertiſement neceſſary to be given to the Readers of the Latin *Verſion, made by Mr.* Sterpin *at* Copenhagen, *of the* Philoſophical Tranſactions *of A.*1669; *printed at* Franckfurt *on the* Main *by* Dan. Pauli, *A.*1671.

This Advertiſement relating chiefly to Forrain Readers, it was thought more proper to deliver it in *Latin*, than *Engliſh*; viz.

C*VM nuper incideret* Tranſactionum, *ut vocant*, Philoſophicarum *Author Anglicus in earum Verſionem, quæ A.*1669. *ſermone Anglico editæ fuerant, deprehenderétque innumera inibi occurrere, tam à Scriptoris ſenſu, quàm à Latini ſermonis genio, nec non ab ipſo Decoro nimiùm abludentia, utique cohibere ſe non potuit, quin extraneum imprimis Lectorem moneret, quam maximè ab hac Verſione ipſi eſſe cavendum.*

Ne autem gratis hoc dici Lector candidus exiſtimet, pauca ex per-multis in verſione dicta commiſſis erroribus & vitiis enormibus ſpecimina hîc ſiſtam, ut exinde judicare quilibet de cæteris poſſit.

Principiò, Indecorum omninò videri poſſit, Titulum illum Anglicum, qui primariæ Nobilitatis Viris, tam Eccleſiaſticis quàm Secularibus, apud *Anglos* debetur, vocibus My Lord and your Lordſhip expreſſus, Latinè ab hoc Traductore reddi vocabulis, *Mi Domine, &, Dominatio tua*; quod familiare præ ſe fert alloquium paris ad parem. Id verò in Verſione *Dedicationis*, Reverendiſſimo Epiſcopo *Salisburienſi* adſcriptæ, perquàm inſulſè factum.

Deinde, Verſionis hujus initium perperam ibi factum, ubi Reſponſiones habentur ad complura *Quæſita*, nec tamen *Quæſita* illa in parte Latinè verſa comparent.

Inſuper, operarum Typographicarum Corrector complura peſſimè punctata, in veri ſenſûs fraudem, & immane Lectoris tædium, dimiſit,

Adhæc ne inſiſtam recenſendis innumeris dictionibus planè ineptis, quales ſunt *primo* in Dedicatione; *ſcintillis vitam dare*, pro, *ſcintillas ſuſcitare*; it. *apparitiones*, pro, *phænomena*; it. *diſtantia*, pro, *diſcrimen*; it. *rectam lineam ſtrictiùs ſequi*, pro, *ſemitam rectam oculis irretortis calcare*; Deinde, in ipſo Opere, ut, *p.*4. *l.*12. *ſtirpes majoris famæ*, pro, *celebriores*; it *p.*5. *l.*22. *in contemptum plurium medicaminum*, pro, *multis medicaminibus nequicquam adhibitis*; it. *p.*6. *l.*13. *ſucci acervo*, pro, *ſucci penu*, *p.*9. *l.* 5. *vividum arboris incipere cernere licet*, pro, *arborem exerere vigorem ſuum videbis*. *p.* 13. *l.*10. *corroſionem*, pro, *decorticationem*. *p.*17. *l.*24 *pericula*, pro, *experimenta*. *p.*19. *l.*17. *hi tractatus*, pro, *hæ pagellæ*. ib *l* 23. *conferentiâ*, pro, *colloquio*. *p*, 20. *l.*12. *merſor*, pro, *urinator*. ib. *l.*15. *meum ſpiritum exire inhibui*, pro, *habitum meum inhibui*. ib. *l.*21. *camphoræ ſimilans*, pro, *caphuram referens*. ib. *l.*22. *alembico opertis*, pro, *in alembico diſtillatis*. *p.*22. *l.* 1. *ſi quid vobis in oculis cadat, occæcabimini*, pro, *ſi quid fortè oculis illabatur, cœcitatem inducet*. ib. *l.*23. *comitata fuerunt*, paſſivè poſuit, cùm pueri norint eſſe deponens. *p.* 22. *l.* 15. *ut præcipitat*, pro, *præcipitet*. *p* 32. *l.*17. *complectuntur*, poſuit paſſivè, cùm ſit deponens; obvia erant verba, *comprehenduntur*, *continentur*. *p.*34 *l.*20. *ut poteſt*, pro, *poſſit*. ib. *l.*23. *de quo ſui ipſius verba vobis reſpondebimus*, pro, *cui ipſiuſmet verbis ita reſpondemus*. *p.* 36. *l.*13. *ſublevat*, pro, *ſolvit*. *p.*38. *l.* 24. *additionis, ſubtractionis* pro, *additionem, ſubtractionem*. *p.* 39. *l.*3. *rectis lineis figurarum*, pro, *figurarum rectilinearum*. ib. *l.*21. *ſuis habitantibus*, pro, *ipſius incolis*. *p.*40 *l.*14. *largitudo*, pro, *amplitudo*. *p.*41 *l.*6. *oculo in uno polorum conſtante*, pro, *oculo poſito in uno polorum*. ib. *l.* 15. *coluræ*, pro, *coluri*.ib.*l.*18.*circuli*,pro,*circulorum*.p.42.*meram mutationem committens*, pro, *admiſſâ duntaxat mutatione*.p.48.*l.*5.*Joh.Waliem methodum agnoſcentem ac utentem*,pro,*Joh.Walliſium,methodum agnoſcentem,eaque utentem*.p.49.*l.*14. *excuſſum* pro,*excuſum*.p.52.*l.*15.*theorematis* 3, pro, *theoremata tria exhibet,oſtendens proportionem*,&c.

Sed, inquam, ne his & Sexcentis aliis (modeſtè loquor) ſolæciſmis & barbariſmis immorer, pergo notare pauciſſima ex innumeris, quæ ſenſum ipſum vel perturbant vel omninò convellunt; idque duntaxat in *Num. primo* hujus Verſionis; qualia ſunt: Pag.5.*l.*23.*omne,gummi applicato pruni, in aceto diſſoluto*; ſenſus eſt,*malum omne,prunorum applicato gummi,eoq;in aceto diſſoluto,ſanatum fuit*.p.10.*l.*10.*magis*,pro,*diutius*. p.11.*l* 14,15.*æquinoctium*, pro,*Solſtitium*.ib.*l.* 19.*in punctis ligni circuli*,ſenſus eſt,*in punctatis trunci circulis* p.12.*l.*26.poſt voc.*involucri*,omiſſa ſunt verba *uſque ad ipſiſſimum lignum ſolidum*.p.13.*l.*4.poſt voc.*cortice*, omiſſum,*circumcirca*. p.14.*l.*8. *viſco*, pro, *tilia*.ib.*l.*25 *aſcendentem*,pro,*deſcendentem*.ead lin.*vel carmen pulpamve*, pro, *pulpam vel tegmen*.p.15.*l.*21.*ſcindendo exiguum vimen recens natum, medullæ in aliquib. ramulis,& per hoc aliis ejuſdem magnitudinis*; ſenſus eſt,*in nuce obſervatio inſtitui poteſt, tenellos quoſdam ramulos ad ipſam uſque medullam ſecando, nonnullos verò alios,ejuſdem maguitudinis per medullam ipſam tranſadigendo*.ib.l. ult.*alius quantitati*,pro,*alterius*.p.17.*l.*1.& 9.*fraxinus*,pro,*populus alba*: *Anglicum* Aſh & Aſpe idem ſonabant noſtro Traductori.p.22.l.3. accepit adjectivum theeving pro nomine proprio, quod reddendum erat, *prædatrix*. p.29.*l.*16,17.lege, *à ſe & altero illo mathematico coram dicta Soc. factis confirmaverit*; ſenſus alioqui non apparet.p.36.*l.*5 *eadem Eclipſis*,pro,*ejuſmodi*. p.37.*l.*21.*Letwardum*,pro,*Sethum Wardum*. p.39.*l.*22. *libris*, pro,*infantibus*. p.49.*l.*26.*aliquâ*,pro, *quavis*. p.50.*l.*13. *cujus altit. eſt peripheria, vel à centro ejus gravitate deſcripta*; ſenſus eſt,*Cujus altit eſt peripheria à gravitatis ipſius centro deſcripta*.p.51.*l.*14.*prominentiam*,pro,*ungulam*.ib.*l.*17.*ſpiram*, pro,*fuſum*. ib.*l.*18.*axem*,pro,*baſin*.ib.*l.*19.*eſſe ſicut baſin eſt ad* $\frac{16}{15}$ *axis*,pro,*ſicut baſis parabolæ eſt ad* $\frac{16}{15}$ *axis*. ib. *l.*20. *parabolam æqualem habere proportionem circulo circa ſuam baſin ut diametro,deſcripto,ac parabolæ ejuſdem circuli axis circumferentiæ habet,cujus rad.æqualis eſt centro gravitatis ab axi ſemi-parabolæ*: Quis mortalium ex his verbis ſenſum exſculperet, qui in Anglico huc redit; *Prop.29 tradit author,parabolam,eam habere proportionem ad circulum deſcriptum circa baſin ceu diametrum, quam habet axis parabolæ ad circumferentiam circuli, cujus radius æqualis eſt diſtantiæ centri gravitatis ſemi-parabolæ ab axe*. p. 52. l.12. *eminentias*, pro,*ungulas*. ib.l.17. *inquirendo*,pro,*requirendo*.

Piget omninò, plura conſectari; finem quippe vix invenirem: Ea enim, quæ diſpunxi, menda & vitia nonniſi pauca ſunt ex permultis ſolius *Numeri* 1. Devorare hoc tœdium cogebar, ut conſtaret Lectori, quid de Verſione tota eſſet expectandũ. Si ipſe forſan interpres ſtricturas haſce in malam partem accipiat, memorem eum eſſe velim dicti: *Quicquid cogit,excuſat.*

Inſpecto dehinc N°. 45, ubi deſcribitur inſtrumentum Opticum Dn. *Wrenni*, nec non Obſervatio Saturni facta à D. *Hugenio* & D. *Picardo*, verſionem utriuſque argumenti per-ridiculam deprehendi, &c.

ERRATA in this number. *P.*2248.*l.*7.*r.*ſurd *for* ſaid. *ib.l.*29.*r.*the Fraction $-\frac{4}{14}$ twice. *p.* 2249. *l.* 2. *r.*204.$-\frac{4}{49}$ which. *p.*2250.*l.*7.*r.* three *for* four. *p.* 2260. *l.*5.*del.*the.

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Numb. 76.

PHILOSOPHICAL TRANSACTIONS.

Octob. 22, 1671.

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Obſervations, made by ſeveral Aſtronomers, domeſtic and forrain, of the late Eclipſe of the Moon, *on Septemb.* 8. 1671; *here delivered in the Languages, in which they were Communicated.*

1. That of Mr. *Street* was this, in *London.*

	°	′	Time by Altitudes corr. by parall. and refract. h.	′
The *Emerſion*: Altit. of the upper edge of the ☾	10	30	7	21
The *End* of the Eclipſe: Alt. of *Arcturus*——	16	20	8	16⅓

By my Tables (*ſaith he*) of *Aſtronomia Carolina*;

	T. app. h.	′	″
The Beginning at ——————	4	50	8
Immerſion ——————	5	47	44
Middle ——————	6	34	55
Emerſion ——————	7	22	6
End ——————	8	19	42

2. Ann. 1671, d. 8. Sept. *circa horam ſextam veſpert. Luna aſcendebat totaliter obſcurata ſub Elevat. Poli* 50°. 15′. *Ectoniæ in Comitatu Nerthamptoniano* Angliæ. *

Cœpit emergere ex Umbra, centro Lunæ alto 9°. 35′, *ſive hor.* 7. 18′.

Finis, Arcturo alto 16°. 30′, *ſive ho.* 8. 16′. 20″: *Unde computatur Medium Eclipſis fuiſſe hor.* 6. 28′. 16″.

3. The Learn'd *Bullialdus* communicated from *Paris*, about this Eclipſe, the following Obſervations; which, by his favour, we ſubjoyn thus;

Ex Epilogiſmo Calculi Eclipſis Lunæ, quæ facta eſt d. 18 *Septembris ſt. nov. ex Tab. Philolaicis;*

Datur

* Obſervante Doctiſſimo Dn. *Palmero*, teſte Dn. De *Bellieres*, Gallo, præſente cùm Obſervatio hæc perageretur.

Datur Uraniburgi T. A.	h.	'	''	*Pariſiis.*	h.	'	''	*Latit. Lunæ veræ.*	'	''
Initium	5	50	29	*Init.*	5	10	29	*Initio*	1	13
Total. obſc.	6	50	29	*Tot. obſc.*	6	10	29	*Fine*	12	48
Max. obſc.	7	40	18	*Max. obſc.*	7	0	18			
Vera ☍	7	41	22	*Vera* ☍	7	1	22			
Emerſio	8	30	7	*Emerſio*	7	50	7			
Finis	9	30	7	*Finis*	8	50	7			

Obſervatus eſt Pariſiis	g.	'	''
Finis, alto Arcturo ad Occaſum	13	41	
Ablatâ refractione, alto	13	37	45
	h.		
Hinc datur finis obſervatus	8	29	16
	g.		
Finis Penumbræ alto Arcturo	13	0	
Correct.	12	56	
	h.		
Unde datur	8	33	40
Cœlum ergo anticipavit Tabularum calculum		20	51
Heckerus *in Ephemeridibus ponit finem* ex Rudolphinis,	h.	'	''
Uraniburgi T. A.	9	37	7
Fuiſſet Pariſiis	8	57	7
	g.		
Cœlum ergo anticipavit Calc. Rudolph.	0	0	27
	h.		
Obſervata eſt Mæotis *tota extra Umbram*	8	24	16
	g.		
Alto Arcturo	14	26	0
Correct.	14	23	55

Exivit Luna ex umbra è regione Petræ Sogdianæ Hevelii.

Ex Epilogiſmo juxta Tab. Britannicas Clariſſimi Viri Vincent. Wingi,

Datur Londini T. A.	h.	'	''	Pariſiis *fuiſſet.* H.	'	''
Initium	4	56	49	5	4	49
Total. obſc.	5	56	32	6	4	32
Max. obſc.	6	46	0	6	54	0
Vera ☍	6	46	58	6	54	58
Emerſio	7	35	28	7	43	28
Finis	8	35	11	8	43	11

Tabulæ Britannicæ anticipant Cœlum 13' 55''.

Luna Oriens tota ſub Umbra fuit, nec nubibus obſtantibus videri potuit. Intra nubes ſubinde viſa eſt tota ſub umbra, antequam ex hac emergeret.

So far Monſieur *Bullialdus.* Hoping, there will ſhortly come to hand the Obſervations, touching the ſame Eclipſe, of ſome other Aſtronomers both Engliſh, and Forrainers, and theſe of *Paris, Uraniburg, Dantzick*, &c. we ſhall not fail, God permitting, to publiſh them hereafter.

An Account of the Diſſection of a Porpeſs, *promiſed Numb.* 74; *made, and communicated in a Letter of Sept.* 12. 1671, *by the Learned Mr.* John Ray, *having therein obſerv'd ſome things omitted by* Rondeletius.

SIR,

About the later end of *April* 1669, being at Weſtcheſter with my Lord Biſhop of that Dioceſs, in the company of *Fr. Willughby* Eſq; I had the good fortune to meet with a young *Porpeſs* of a convenient ſize for Diſſection, brought thither by ſome Fiſhermen, who caught him upon the Sands, where the Tide had left him; in the Anatomy whereof I obſerved ſome things omitted by *Rondeletius* in his Deſcription of the *Dolphin.*

The length of this was by meaſure 3 feet and 7 inches. A ſtring of 2 feet and 2 inches girded him in the thickeſt place. The ſhape of his body was not much unlike that of a *Tunny fiſh*; only his ſnout longer and ſharper. His skin was thin, ſmooth, and without ſcales. In an old and well grown fiſh its like the skin may be thick and tough, as *Rondeletius* repreſents it.

His Fins are cartilagineous, and flexible, not ſharp or prickly, as the Ancients report them. On his back he hath only one, which was diſtant from the tip of his ſnout 1 foot and 9 inches; and the baſis of it in length 5½ inches; ſo that meaſuring from the tip of his ſnout to the end of the tayl, it was ſcituate ſomewhat below the middle of the fiſhes length. On the Belly it had only one pair of fins, 9½ inches diſtant from the tip of the lower mandible, much about the place, where the foremoſt pair of fins in other fiſhes uſually grow. The Tayl is forked, of the figure of a Creſcent; the breadth thereof from angle to angle 11 inches. The *ſitus* or poſition of it contrary to that of all other fiſhes, except thoſe of this kind. For, whereas the plain of the tayl of other fiſhes, when they ſwim, ſtands erected perpendicularly to the plain of the Horizon, in this fiſh (and I ſuppoſe in all others of the *Cetaceous* kind) it lyes parallel thereto. The reaſon whereof I conceive to be *partly* to ſupply the uſe of the hindmoſt pair of fins in other fiſhes, which ſerve to ballance the body, and keep it up in the water, anſwering in proportion to the hinder legs of a Quadruped; hence we ſee, that thoſe fiſhes, which have long bodies and but one pair of fins, as Eeles and the like, cannot keep themſelves up in the water, but lye always grovelling on the bottom: *partly*, to facilitate the fiſhes aſcent to the top of the water (to which he can immediately raiſe himſelf by a light jerk of his tayl thus placed) for the uſe of reſpiration, which is neceſſary for him, as for Quadrupeds. For, doubtleſs if violently deteined under water, he would in a ſhort time be ſuffocated or drowned.

Immediately under the skin lay the fat, which, as I remember, our Seamen call the *Blubber*: It was firm, full of fibres, and in this ſmall fiſh, of an inch thickneſs, encompaſſing and encloſing the whole body, back, belly and ſides. The uſe whereof I conceive to be, 1. to keep the cold water at a diſtance from the bloud, which is, I believe, actually and to the touch hot, in a degree not much inferiour to that of Quadrupeds, and therefore by immediate contact of the water would be apt to be chilled. 2. To keep in the hot ſteams of the bloud from evaporating; by that means alſo preſerving and maintaining its natural heat: as we ſee water, and any other liquour in a cloſe veſſel will retain its heat much longer than in an open; and nothing is more proper to detain the fineſt and ſubtilleſt evaporations and ſpirits, than oyl or fat. 3. Perhaps alſo, to lighten or counterpoiſe the body of the fiſh, which would otherwiſe be too heavy to move and ſwim in the water. Under the Blubber lay the Muſculous fleſh like to that of Quadrupeds, but of a darker colour.

The Body was divided into three Regions or *Ventres* like a Quadrupeds, *viz.* Head, Breaſt, and Belly; the veſſels and *viſcera* in each *venter*, for the main, the ſame as in Quadrupeds: 1. The Abdomen was compaſſed about with a ſtrong *Peritonæum.* The Guts joyned to the Meſentery, and of a very great length, by meaſure 48 foot, without any difference or diſtinction of great and ſmall; neither was there any Blind-gut, or Appendix, that I could find. The Stomach was of a ſtrange make, being divided into two large bags, beſide other ſmaller ones. I found nothing in it, but a good number of thoſe little long fiſhes, which our Fiſher-men dig out of the Sands at low water, and therefore call in ſome places Sand-Eeles; by ſome they are called *Launces*, and by Geſner, *Ammodytæ*.

The Liver was of a moderate ſize, ſcituate in the right ſide, and divided into two lobes, having no *cyſtis fellea* or receptable of Gall annexed. The *Pancreas* large, ſticking cloſe to the third bag of the Stomach, into which alſo its *ductus* enters, and emptys it ſelf. The Spleen ſmall and roundiſh. The Kidneys larg, ſticking cloſe to the back, and lying contiguous one to the other, made up of many little kernels, like to, but much leſſer than, thoſe of an Ox; of a flat figure, having no *pelvis* in the middle, but the Ureters going out at the lower end.

The Urin bladder oblong, and little for the bulk of the Animal, having on each ſide a round ligament, made of the umbilical arteries degenerating. The *Penis* long, ſlender, having a ſmall ſharp *Glans*; it appears not outwardly, but lies hid in its ſheath within the body, doubled up or rather reflected in the form of the letter S, as is that of a Bull. The Teſticles lye within the cavity of the *Abdomen* on each ſide, as they do in an Hedg-hog, and ſome other Quadrupeds, of an oblong figure; for their internal ſubſtance, Seminal veſſels both *præparantia & deferentia*, *Epididymides*, *Vas pyramidale*, *Corpus varicoſum*, & *glandulæ proſtatæ*, exactly like to thoſe of Quadrupeds. The Seminal veſſels perforate the *Urethra* with many little holes, whereof four are moſt conſpicuous ſomewhat above the neck of the bladder.

The Diaphragm was muſculous, as in Quadrup. The Heart large, included in a *Pericardium*, had its two Ventricles; its *valvulæ Sigmoides ſemilunares*, *tricuſpides & mitrales*; its coronary arteries and veins: in a word, the whole ſtructure and ſubſtance of the heart and lungs agreed exactly with that of Quadrupeds. The Windpipe was very ſhort, as it muſt needs be, the fiſh having no neck; the *Larynx* at top was of a ſingular figure, running out with a long neck, and a nob at the end like an old faſhioned Ewer.

The pipe in the Head, through which this kind of fiſh draw their breath, and ſpout out water, lies before the brain, and ends outwardly in one common hole, but inwardly its divided by a bony *ſeptum*, as it were into two noſtrils; but below again it opens into the mouth in one hole. This lower orifice is furniſhed with a ſtrong *Sphincter*, whereby it may be ſhut and opened at pleaſure, and above this *Sphincter*, the ſides of the pipe are lined with a glandulous fleſh, which if you preſs, you ſhall ſee ſtart,out of many little holes or *papillæ* into the cavity of the pipe, a certain glutinous liquor. Above the noſtrils is a ſtrong valve or membrane like an *Epiglottis*, which ſerves to ſtop the pipe, that no water get in there againſt the fiſhes will. Within the *fiſtula* are ſix blind holes having no out-let; four tending toward the ſnout; two above the valve that ſtops the noſtrils; and two beneath it; two tending towards the brain, having a long but narrow cavity for the uſe of ſmelling, as I conjecture, though opening the brain I could find neither olfactory nerves nor *proceſſus mammillares*. The Eyes are ſmall conſidering the bigneſs of the fiſh, and ſcituate at a good diſtance from the baſis of the brain. The Snout is long, and furniſhed with very large muſcles, to root or turn up the ſand at the bottom of the Sea for to find fiſhes, as appears in that we found nothing in his ſtomach but Sand-Eeles, which, as was intimated before, lye buried in the Sand. The Brain and *Cerebellum* are,for the ſubſtance and *anfractus* of them, the ſame with thoſe of Quadrupeds, only differing in the figure, as being ſhorter: But what they want in length, they make up in breadth. They have alſo the like teguments called *dura* and *pia-mater*. Six or ſeven pair of nerves, beſides the Optick: the ſame ventricles; only in the *medulla oblongata* we obſerved not theſe protuberances called *nates* and *teſtes*. The Skull (*Cranium*) is not ſo ſtrong and thick, as in Quadrupeds, but articulated after the ſame manner to the firſt *Vertebra* of the back-bone. This largeneſs of the brain, and correſpondence of it to that of man, argue this Creature to be of more than ordinary wit, and capacity, and make to ſeem leſs fabulous and improbable thoſe Ancient ſtories, related by *Herodotus* concerning *Arion*: By *Pliny* the Elder*

concerning

* L. 9. hiſt nat. c. 8.

concerning a Dolphin enamoured of a Boy, whom he was wont to carry croſs a bay of the Sea, from *Baiæ* to *Puteoli*, to School,*&c.* By *Pliny* the Younger, of another enamoured of a boy at *Hippo* in *Africa*, whom he was wont to carry upon his back in like manner. The ſtory is worth the noting: *Epiſt.*33.*l.*9.

But to proceed; this fiſh had in each Jaw 48 teeth,ſtanding in a row like to little blunt pegs. The Tongue was flat above, of an equal breadth to the very tip, which was toothed or pectinated about the edges, tyed firmly down to the bottom of the mouth all along the middle,as *Ariſtotle* truly ſaith: whence I cannot but wonder, that *Rondeletius* ſhould herein contradict *Ariſtotle*, and affirm (contrary to truth, as I believe) *quòd Dolphinis lingua eſt mobilis, quæ modò exeri modò condi poteſt:* Unleſs perchance in this particular the Dolphin differs from the Porpeſs. For the Porpeſs is, as I take it, the *Phocæna* of the Ancient, which is a leſſer ſort of Dolphin, and not the *Dolphinus*; at leaſt if the fiſh, we are deſcribing, were a Porpeſs; for the teeth of this fiſh were leſſer than, and of a different figure from, thoſe in the jaw of the Dolphin we got beyond Seas: yet is the difference not great between the *Dolphin* and *Phocæna.* As for that fiſh, which our Sea-men now adays call the Dolphin, and which, as it is deſcribed by Mr.*Terry* and *Ligon*, hath teeth on its tongue, ſmall ſcales, is finn'd like a rock, of a pleaſant ſmell and taſt; what it is I know not, but I am ſure it is *toto genere* different from the *Dolphin* of the Ancients.

We obſerved not in this fiſh any Noſtrils beſides thoſe in the *fiſtula*,nor any ear-holes or *meatus auditorii* at all; wherein alſo *Ariſtotle* agreeth with us; which yet *Rondeletius* found out near the eyes: it being manifeſt,ſaith he, that a Dolphin doth hear, and ſeeing no creature can hear without a paſſage for that purpoſe to convey ſounds to the brain: *Hac ratione impulſus, cùm Delphini cranium diligentiſſimè contemplatus eſſem, manifeſtiſſimum audiendi meatum, qui ad cerebrum uſque patet, inveni ſtatim poſt oculum,tam exiguum, ut ferè oculorum aciem fugiat.* And we obſerved in the Skull a bone anſwering to the *Os petroſum*, which moſt certainly was for the uſe of hearing. It had 6 ſhort Ribs that had no Cartilages,and ſeven that had Cartilages (on each ſide I mean.) The Breaſt-bone was very ſmall. As for the name *Porpeſs*, I agree with *Geſner*, that it was ſo called, *quaſi Porcus Piſcis*, moſt nations calling this fiſh *Porcus Marinus*, or the Sea-ſwine. Indeed it reſembles a Swine in many particulars, as the fat, the ſtrength of the ſnout, &c.

A Letter of Francis Willoughby *Eſquire, of* Auguſt 24. 1671. *Containing ſome conſiderable Obſervations about that kind of Waſps, call'd* Veſpæ Ichneumones; *eſpecially their ſeveral ways of Breeding, and among them, that odd way of laying their Eggs in the Bodies of Caterpillars, &c.*

AS I remember, M. *Liſter's* opinion is, that the *Muſcæ Ichneumones* lay their Eggs in the bodies of Caterpillars; which I look upon as very ingenious and true, and muſt ſubſcribe to it, though I cannot yet abſolutely demonſtrate it, as I hoped I ſhould have done before this. Theſe *Ichneumones* have all four wings, *Antennæ* like Bees; their body hanging to their breaſt by a ſlender ligament, as in Waſps; moſt, if not all, have ſtings, and are made of a maggot, that ſpins her ſelf a *Theca* before ſhe turns into a *Nympha*. There is great variety of them; *Some* breed, as Bees do, laying an Egg, which produceth a maggot, which they feed till it comes to its full growth: *Others*, as we gueſs, thruſt in their Eggs into plants, the bodies of living caterpillars, maggots, &c. For, it is very ſurprizing to obſerve, that a great Caterpillar, inſtead of being changed into a Butter-fly (according to the uſual courſe of nature;) ſhould produce ſometimes one, ſometimes two or three, and ſometimes a whole ſwarm of *Ichneumones*. I have obſerved this Anomalous production in a great many ſorts of Caterpillars, both hairy, and ſmooth; in ſeveral ſorts of maggots, and, which is moſt ſtrange, in one Water-inſect. When there come many of theſe Ichneumon maggots out of the body of the ſame Caterpillar, they weave all their *Theca's* together into one bunch, which is ſometimes round with web about it, juſt like a bag of ſpiders Eggs; but I dare venture to anſwer M. *Liſter's* 10*th Quære* pag. 2172. of the Phil. Tranſ. negatively, that none of them feed upon ſpiders Eggs, but it is the ſimilitude of thoſe *Theca's*, conglobated together, to

the

the Eggs of Spiders, that hath occaſioned the conjecture.

One of the green Caterpillars, common in the Heaths in the North, went ſo far on to her natural change, that ſhe made her ſelf up into a great brown *Theca*, almoſt of the ſhape of a bottle, which was filled with a ſwarm of *Ichneumones*. And I have obſerved in one or two other ſorts, that from the very *Aurelia* it-ſelf hath come an *Ichneumon*; which is very odd, that the Caterpillar, ſtung and impræguated by the *Ichneumons*, ſhould be yet ſo far unhurt, and unconcerned, as to make her ſelf a *Theca*, and to be turned into an *Aurelia*.

I have often ſeen a great *Ichneumon* dragging a Caterpillar in the high-way. This year Mr. *Wray*, in company with another ingenious neighbour, obſerved one haling a large green caterpillar much bigger than her ſelf, which after ſhe had drawn the length of a pearch, ſhe laid down, and then takes out a little pellet of Earth, with which ſhe had ſtopped the mouth of a ſmall hole like a worm-hole; then ſhe goes down into it, and ſtaying a very little comes up again, and draws the *eruca* down with her into the hole, and there leaves her; and afterwards not only ſtops but fills up the Hole, ſometimes carrying in little clods, and ſometimes ſcraping duſt with her feet, and throwing it backwards into the hole, going down after, her ſelf, to ram it cloſe. Once or twice ſhe flew up into a Pine-tree, which grew juſt over her hole, perhaps to fetch Cement; When the hole was full and even with the ſuperficies of the ground about it, ſhe draws two Pine-tree-leaves, and lays them near the mouth of the hole, and flyes away. Not taking notice that ſhe came any more in three or four days, we digged for the Caterpillar, and found it pretty deep. I put it into a box, expecting it would have produced an *Ichneumon*, but it dried away and nothing came of it. We lately obſerved a ſort of *Ichneumons*, or rather *veſpæ*, which prey upon ſeveral ſorts of flyes; when they fly with them, they hold them by the heads, and carry them under their bellies. Theſe make holes a great depth in the ground, in which they lay their young, and feed them with the flies they catch, creeping backwards into the ground, and drawing the flies after them. I ſuſpect they may at firſt lay their Eggs in the very body of a fly;

fly, but one fly being not enough to bring the young one to its full growth, they feed it with more: Their *Theca's* are at laſt all covered over with the wings, legs, and other fragments of flies.

A Letter of Mr. Martin Liſter, *written at York* Auguſt 25 1671. *confirming the Obſervation in N° 74. about Musk ſented Inſects; adding ſome Notes upon D.* Swammerdam's *book of Inſects, and on that of M.* Steno *concerning Petrify'd Shells.*

SIR,

I Have obſerved the two Inſects, which Mr. *Ray* ſaith, ſmell of Musk, which indeed they do in an high degree. The *ſmall Bees* are very frequent in the Wooles in *Lincoln-ſhire*, and about the latter end of *April* are to be found in paſtures and meadows, upon the early-blown flowers of a ſort of *Ranunculus*, as You have been rightly inform'd; but it is ſomething improper to ſay Bees feed on flowers: And likewiſe the ſame Bees are no leſs frequent on the flowers of *Dens Leonis*, &c. The *ſweet Beetle*, is a very large Inſect, and well known about *Cambridge*. All the trials I have made to preſerve them with their ſmell, have proved ineffectual: For, both ſorts of theſe Inſects will of themſelves in a very few weeks become almoſt quite ſent-leſs. To theſe I ſhall add another ſweet-ſmelling Inſect, which is a Hexapode-worm feeding on *Gallium luteum*.

The Obſervation of the *Veſpæ Ichneumones*, as it hath relation to Spiders, I willingly reſerve for other Papers: yet I may tell you in general, that this kind of Inſect is one of the greateſt puzzels in nature; there being few Excreſcencies of Plants, and very many births of Inſects, wherein theſe ſlender Waſps after divers ſtrange ways are concerned.

Though I be at preſent from my Books, yet I well remember the paſſage, which Mr. *Willoughby* refers you to in *Muffet*[*]. And he is well able to judge, whether the Obſervation be made upon the ſame ſort of Inſect. I conceive it a fault not conſiſtent with Ingenious Spirits, to paſs by in ſilence the Induſtry

[*] See *Numb.* 74. *p.*2221.

of Moderns as well as of Ancient Writers; according to that of *C. Celſus*: *Oportet neque recentiores viros in his fraudare, quæ vel repererunt, vel rectè ſecuti ſunt; & tamen ea, quæ ab antiquioribus poſita ſunt, authoribus ſuis reddere.* You can beſt inform me, what D. *Swammerdam* does in a matter of this nature: when I read in the Account given us by you of his Book, *Numb.* 64; that Snails are both Male and Female; that Caterpillars may teach us, by their feeding, the correſpondence of the vertues of Plants, &c; I am deſirous to know, whether he quote Mr. *Ray* for the *former*, as having publiſh't the Obſervation ten years ago at leaſt; and for the *latter*, the Learned and Noble D. *Columna*, who did propoſe the way of eſſaying the vertues of Plants by the palats of Inſects in the beginning of this Age.

But I leave this, and proceed to a remark of my own; and it ſhall be, if you pleaſe, concerning *Petrified Shells*; I mean ſuch Shells, as I have obſerved in our Engliſh ſtone-Quarries. But Sir, let me premiſe thus much, that I am confident, that you at leaſt will acquit me, and not believe me one of a litigious nature. This I ſay in reference to what I have lately read in *Steno's Prodromus*, that, if my ſentiments on this particular are ſomewhat different from his, it proceeds not from a ſpirit of contradiction, but from a different view of Nature. Firſt then, we will eaſily believe, that in ſome Countries, and particularly along the ſhores of the Mediterranean Sea, there may all manner of Sea ſhells be found *promiſcuouſly* included in Rocks or Earth, and at good diſtances too from the Sea. But, for our Engliſh-inland *Quarries*, which alſo abound with infinite number and great varieties of ſhells, I am apt to think, there is no ſuch matter, as Petrifying of Shells in the buſineſs (or, as *Steno* explains himſelf p. 84. in the Engliſh Verſion, & *alibi*, that the ſubſtance of thoſe ſhells, formerly belonging to animals, hath been diſſolved or waſted by the penetrating force of juices, and that a ſtony ſubſtance is come in the place thereof,) but that theſe Cockle-like ſtones ever were, as they are at preſent, *Lapides ſui generis*, and never any part of an Animal. That they are ſo at preſent, is in effect confeſſed by *Steno* in the above cited page; and it is moſt certain, that our Engliſh Quarry-ſhells (to continue that abuſive name) have no parts of a different Texture from the rock or quarry they are taken, that is, that there is no ſuch thing as *ſhell* in theſe reſemblances of ſhells, but that Iron-ſtone Cockles are all Iron-ſtone; Lime or marble all Lime-ſtone and Marble; Sparre or Chryſtalline-ſhells all Sparre, &c. and that they never were any part of an Animal. My reaſon is: That Quarries of different ſtone yeild us quite different ſorts or ſpecies of ſhells, not only one from another (as thoſe Cockle-ſtones of the Iron-ſtone Quarries of *Adderton* in *York-ſhire* differ from thoſe found in the Lead-mines of the neighbouring mountains, and both theſe from that Cockle-Quarrie of *Wansford-bridge* in *Northampton-ſhire*, and all three from thoſe to be found in the Quarries about *Gunthrop* and *Beavour-Caſtle*, &c;) but, I dare boldly ſay, from any thing in nature beſides, that either the land, ſalt, or freſh water doth yeild us. 'Tis true, that I have picked out of that one Quarry of *Wansford* very reſemblances of *Murices*, *Telinæ*, *Turbines*, *Cochleæ*, &c. and yet I am not convinced, when I particularly examined ſome of our Engliſh ſhores for ſhells, alſo the freſh waters and the fields, that I did ever meet with (N. B.) any one of thoſe *ſpecies* of ſhells any where elſe, but in their reſpective Quarries, whence I conclude them *Lapides ſui generis*, and that they were not caſt in any *Animal-mold*, whoſe ſpecies or race is yet to be found in being at this day.

This argument perhaps will not ſo readily take place with thoſe perſons, that think it not worth the while exactly and minutely to diſtinguiſh the ſeveral *ſpecies* of the things of nature, but are content to acquieſce in *figure*, *reſemblance*, *kind*, and ſuch general notions; but when they ſhall pleaſe to condeſcend to heedful and accurate diſcriptions, they will, I doubt not, be of that opinion, which an attentive view of theſe things led me into ſome years ago. Though I make no doubt, but the Repoſitory of the *R. Society* is amply furniſhed with things of this nature; yet if you ſhall command them, I will ſend you up two or three ſorts of our Engliſh Cockle-ſtones of different Quarries, nearly reſembling one the other and all of them very like a common ſort of Sea-ſhell, and yet if there ſhall not be enough ſpecifically to diſtinguiſh them, and hinder them from being ſampled by any thing of the ſpoils of the Sea or freſh waters or the land-ſnails; my argument will fall, and I ſhall be happily convinced of an Errour.

Another Letter, written of the ſame Gentleman, from York Sept. 13. 1671. *enlarging his former Communications in Numb.* 75. *about* Vegetable Excreſcencies, *and* Ichneumon-Worms.

SIR,

IN my laſt Paper about *Vegetable Excreſcencies*, I was wholly ſilent of the opinion, which Mr. *Willoughby* is pleaſed to favour; and becauſe that worthy Gentleman hath ſo far made it probable, that now it ſeems only to depend upon the good fortune of ſome lucky Obſerver, I am willing to reaſſume my former thoughts, that all thoſe odd Obſervations, we have made of the *Births* of *Ichneumons*, do but beget in me a ſtrong belief, that they have a way yet unheeded, whereby they do as boldly, as ſubtly, convey their Eggs within the Bodies of Inſects and parts of Vegetables.

A fifth and laſt propoſition of that Paper * was, that the *ſubſtance of many Vegetable Excreſcencies ſeemed not to be the food of the worms to be found in them.* My meaning was, that the ſubſtance of the Vegetable Excreſcencies in which thoſe *Ichneumon* worms were to be found, was rather augmented, than diminiſhed or worm-eaten. And the like conformity of their feeding within Inſects is well obſerved by Mr. *Willoughby* *, that the imprægnated Caterpillars ſeem not to be concerned, though their bodies are full of Inſects of a quite different kind, but go on as far as they may towards the atchievement of the perfection of their own ſpecies. Thus I have ſeen a *Poppy-head* ſwoln to a monſtrous bulk, and yet all the Cells were not receptacles of *Ichneumons*, but ſome had good and ripe ſeed in them. I ſhall not refuſe Mr. *Willoughby* (though you know upon what grounds

* See *Numb.* 75. *p.* 2254.

* *See above in this very Tract.*

grounds, I have twice done it to you) the ſatisfaction of an Anſwer to my 10*th Quære*, by him reſolved negatively: It is true, the ſwarms of the *Ichneumons*, coming out of the ſides of Caterpillars, do immediatly make themſelves up into bunches, and each particular *Theca*, from the Cabbage-Caterpillar (for example,) is wrought about with yellow ſilk, as thoſe from the black and yellow-*Jacobæa*-Caterpillar with white, but as for web to cover thoſe bunches of *Theca's*, I never obſerved it but in the green Caterpillar ſo common in our *Lincoln-ſhire*-heaths, which are affixed to Bents or other plants. Theſe in truth never deceived but my expectation, for I verily thought I had found, when I firſt obſerved them, a Caterpillar equivalent to the *Indian* ſilk-worm; but having cut them in two, and expected to have found a Caterpillars *Chryſalis* in the middle, there preſented themſelves a ſwarm of *Ichneumons*: Theſe are as large many of them as my thumb, that is, at leaſt four times bigger then the *Folliculus* or Egg-bag of any Engliſh ſpider that I ever ſaw yet. By good fortune I have not thrown away the boxes, wherein I made the Obſervation concerning *Ichneumons* feeding upon the Eggs of certain Spiders. I have had them in ſeveral boxes, ſome 8, ſome 10, ſome 12 days in *Vermiculo*, feeding upon the very cakes of Spiders-eggs, before they wrought themſelves *Theca's* for further change; and they ſeldome exceeded the number of 5 to one cake of Eggs, &c. ſo that you may aſſure Mr. *Willoughby*, this is no conjecture, but a real obſervation accompanied with more circumſtances, than I am willing at preſent to relate.

An Accompt of ſome Books.

I. Johannis Walliſii, *S.Th.D. Geometriæ Profeſſoris in Academia* Oxonienſi, *Tractatûs de MOTV Pars III. A.* 1671. *in.* 4°.

IN this third and laſt part the Excellent Author (continuing his Doctrine of *Motion*, begun in the two foregoing parts,) treats, amongſt other things, of the Five *Mathematical Powers* (as they are called,) or noted Engines for the facilitation of Motion; which are *Vectis*, *Axis in Peritrochio*, *Trochlea*, *Cochlea*, & *Cuneus* (the Leaver, Winch, Pulley, Screw, and Wedge,) with others reducible to them. And particularly, of the *Leaver* (in its moſt uſual acceptation,) with one ſupport (and therein of the *Pinchers* and *Sheers*, &c.) and of a *Beam*, *Cole-ſtaff*, &c. ſuſtained by two or more ſupporters, with the ſeveral preſſures on each of them, according to their different poſitions; where alſo are deſcribed ſix ſeveral forms of *Flat Roofs*, for large Rooms, framed of ſhort Timbers (much ſhorter than the breadth of the Room,) mutually ſupporting one another: with methods of computing the weight ſuſtained by every joint. Of ſeveral ſorts of *Winchers*, *Winders*, *Capſtans*, *Rollers*, *Wheels of Engines* (with or without teeth,) *Boarers*, *Cranes*, &c. with the Reaſon and Meaſure of their force; As likewiſe the *Wheels of Coaches*, *Carts*, *or Waggons*, with the Reaſon of divers circumſtances in the Fabrick and uſe of them. Of *Pulleys*; of the meaſure and reaſon of their ſtrength. Of *Screws*; with the reaſon of their great force, and the meaſure of it; as alſo, the meaſure of the *Length of the Spiral line about a Cylinder* (whence the Screw takes its riſe,) and of the *Solid content of the Screw*. Of the *Compoſition*, *Acceleration*, and *Retardation* of Motions; and the motion of *Projectils* (things thrown, ſhot, &c.) with the nature of the lines deſcribed by ſuch motions. Of *Percuſſion* or *ſtriking*; with the meaſure and effects of *Blows*, or *Stroaks*, according as the bodies ſtriking do differently occur one to the other, and the *Center of force* in ſuch Percuſſion.

Of the *Wedge*, with the reaſon and meaſure of its force. Of *Repercuſſion*, *Reſilition*, or *Reflexion* of Bodies, which he derives from the *Spring* or *Elaſtick Virtue* in them: Of *Hydroſtaticks*, with the Reaſon and meaſure of ſinking or ſwimming of Heavy bodies in a Fluid: Of the *weight* and *Spring* of the *Air*, and the *Counterpoiſe* of the *Atmoſphere*; from whence he derives thoſe effects, which were wont to be aſcribed to the *Fuga vacui*, or Natures abhorring a vacuity; with the Explication and Reaſon of the ſeveral Phænomena of the *Torricellian* Experiment, and others of like nature, and of the very great contraction and expanſion of the Air: Of raiſing a great weight with a mans *breath*, blowing a *bladder*. And the Solution of divers other *Mechanical* queſtions.

II. Danielis Ludovici, *Medici Ducal. Saxo-Gothani, de PHARMACIA Moderno Seculo applicanda, Diſſertationes III.* Gothæ 1671. *in* 12o.

THe Learned and Experienced Author of this Book, having, it ſeems, really found, that neceſſity ſuggeſts the conſiderableſt and the moſt neceſſary, as well as the eaſieſt and cheapeſt Remedies for Man's health; and having thereupon very ſucceſsfully follow'd in his practiſe a method and rules ſutable thereunto, to the frequent relief and cure of his Patients, and to his own honor; reſolved to publiſh to the world the ſubſtance of his thoughts concerning the Adminiſtration of Phyſick, together with the Sum of his Experience and Practiſe therein; notwithſtanding what the Learned and Induſtrious *Zwelfer* or others had already ſaid upon this Subject; he being perſuaded, that Diſeaſes may as well, if not better, be cured by a few, plain and eaſily parable Medicins, than otherwiſe; provided they be by an honeſt and diſcreet Phyſitian uſed with Judgment, according to the nature, temper and condition of the Patient.

In reference hereunto, he declares himſelf in Three Diſſertations; In the *Firſt*, he ſhews, How the *Materia Medica* may throughout Nature's three kingdoms (as they ſpeak) be contracted, from that vaſt and luxuriant heap, met with in Diſpenſatories

penſatories and other Phyſick-books, to a few ſimple and yet choice and efficacious Medicins; adding thereunto, *both* his Method of preparing ſuch remedies for all ſorts of diſeaſes,*and* withall ſhewing, how to bring them into a ſmall room,to contain the ſame thus contracted.

In this part the Reader will find the Author's thoughts, firſt touching ſuch Remedies as are pretended to be *Univerſal*; and ſecondly, an Enumeration of ſome of the choiceſt *Particular* Medicaments, of all ſorts; as Purgatives, Vomitives, Sudorificks, Aſtringent, Refrigeratives, Diureticks, Reſolving, Diſcuſſing, Corroborating, Deterſive, Anodyne,Narcoticks, Stomachicks, Hepaticks, Spleneticks, Uterine, Topicks, &c. Concerning all which he ſticks not to ſay,that he hath nothing raſhly nor groundleſly aſſerted of the Medicins by him retained or diſcarded.

In the *Second* he briefly treats of the neceſſity of Moderating the Rates of Medicins; which yet he doth in ſuch a manner, that on the one hand, Druggiſts, Apothecaries, &c. may not want encouragement to provide all neceſſary matter of Phyſick; and on the other hand, that the Common people may not be alienated from employing honeſt and skilful Phyſitians, nor from the uſe of proper medicins: where he particularly examins the *Chymical* preparations, (to which he is no Enemy,) and delivers his opinion as to what cheat there is frequently practiſed in priſing them, and how men may be directed to know very near the true rate of many of that kind.

In the *Third* he enumerates the benefits that may redound to Man-kind, by the way of Diſpenſing Medicins by Phyſitians themſelves, ſworn and skilful; as he obſerveth it to have been in the beginning, and even ſo late as in the next foregoing Age, and to be ſtill practiſed in all the *Aſiatic* Countries; Which he ſaith he adviſeth, not to countenance any dangerous way of preparing Medicins, but to ſecure the making of phyſick to well-known diſcreet and experienced Practitioners; conceiving, that thereby the poorer ſort of people, finding the Fee and Price of Phyſick to be in one hand, would be much leſs ſhy, than now they are, to repair to good

Phyſitians, and more deterr'd from conſulting *meer* Empiricks and Mountebanks, making great havock amongſt them; beſides that Phyſick would by that means be much improved; Intruders debarr'd from doing miſchief by the indiſcreet uſe of Receipts; and many ſudden Accidents, which admit not of the delay of ſtaying for both Phyſitian and Apothecary (as Apoplexies, Epilepſies, Hyſteric fits, &c.) better provided for.

Here and there the Author taketh occaſion to animadvert on thoſe pretended high *Arcana's*, *Catholicon's*, *Panacea's*, *Elixir's*, *Univerſal Menſtruum's*, particularly the *Alcaheſt*; yet without denying, that there may be *one* and the ſame Medicin ſo excellent as exceedingly to ſtrengthen and cleanſe the body, and to give relief in *many* diſeaſes.

Where he diſcourſeth of fitting Medicins to the Conſtitution of people, he obſerveth, that a certain ſort of laxative Aloe-pills are properer for Countries and people that drink Bier, than thoſe that drink Wine. And ſo he noteth, that Venæ-ſection is more uſeful to ſome Nations, than others.

If the Author had taken care to have delivered his matter in a clear ſtile, he would certainly have proved much more inſtructive, than, 'tis feared, he now will. This *Deſideratum*, we hope, will be ſatisfied in the ſecond Edition.

III. Joh. Bapt. Sylvatici *INSTITUTIO MEDICA de iis qui* Morbum ſimulant *deprehendendis.* Francofurti ad Mænum. *A.* 1671. *in* 12°.

THis *Italian* Author, having repreſented both the Importance of this argument, and aſſigned the Cauſes inducing people either to counterfait or to hide Diſeaſes (which he reduces to Fear, Shamefaſtneſs, and Profit;) enumerates the ſeveral Ways, how this Simulation or Diſſimulation may be performed. And of theſe he obſerveth chiefly three: The *firſt*, when a Sickneſs is pretended by Words only, and really is not; as a Colick, Head-ache, &c. to avoid appearance in publick or for other reaſons. The *ſecond*, when there appear ſigns and marks of diſeaſes in the Body, but are cauſed on purpoſe by Counterfaits for various ends; ſuch as ſeem to indicate a Fever, Scabbines, Leproſy, an Exulceration of the Lungs by ſpitting bloud, and Gravidation it ſelf, either to raiſe Compaſſion, as in Beggars, (as in the laſt caſe,) for Succeſſion, as in great Women, making it up by Suppoſititious Births. The *third*, when there is really a ſickneſs, but hid and concealed to the utmoſt; as the *Venereal Diſeaſe*, to avoid publick ſhame, or the loſs of an advantagious match, and eſpecially *Love ſickneſs*, cover'd out of modeſty, or for other cauſes, but often inducing a high degree of Melancholy, and ſometimes Madneſs.

This being diſpatched, he giveth ſeveral Directions, *firſt* in *general*; How counterfaited ſickneſſes may be found out, and the various arts and cheats detected: For the due performance of which, he judgeth it not ſufficient to have great Medical Experience, but beſides finds it requiſite to employ more than ordinary ſagacity in exploring all circumſtances and outward accidents, and eſpecially thoſe things, that relate particularly to the genius, temper and ſtate of the ſuppoſed Counterfeit.

Secondly in *particular*; where he teacheth, how thoſe are to be diſcover'd, that counterfeit Pain, and pretend Impotency, Sterility, Virginity (*circa ultimum hoc argumentum multa diſſerens curioſa, tum de variis eam mentiendi modis, tum de deprehendendæ mentitæ difficultatibus, tum de* Hymenis *exiſtentia*;) Further thoſe that fain or conciliate Madneſs, or Inſenſibleneſs, for times and occaſions; as alſo ſuch, that raiſe, by art, Tumors, Scabs, Ulcers, Fevers, and Bloud-ſpitting. Moreover, how to detect diſguiſed Love-ſickneſs, together with divers Examples of its Diſcovery, and the method and ſlight employed both in making that diſcovery, and in curing the malady; for the latter of which he commends chiefly the import of that of the Poet, *Intrat amor mentes uſu , dediſcitur uſu ;*

And the advice of *Lucretius* ;

Sed fugitare decet ſimulacra & pabula amoris,
Abſterrere ſibi atque aliò convertere mentem
Ac jacere Amorem collectum in Corpora quoque.

To which he adds the way of diſcovering ſuppoſed Dæmoniacks, and Enthuſiaſts; yet acknowledging withall the difficulty of diſcerning ſuch Impoſtures; of which he eſteemeth many may be aſcribed partly to Melancholie, partly to Uterin-fits, partly to plain Cheating, as is that of the *Ventriloqui.*

He ſubjoins the method of finding out women that hide their Conception, and thoſe that counterfeit it: And concludeth all with the skill requiſite to diſcover ſuch as are infected with the *Lues Venerea*, and ſtudy to palliate it with ſome other Diſeaſe; and thoſe alſo to whom Poiſon hath been given ſecretly.

IV. *QUADRIPARTITUM BOTANICUM* Simonis Pauli *Medici Regii in* Dania *Argentorati in* 4°.

HAving been lately queſtioned by ſome conſiderable men (one of whom is a Learned Phyſitian of *London*,) why no notice had been taken in theſe *Tracts* of this Uſeful piece, we thought good, (alledging, for the excuſe of our tardineſs herein, this Book's eſcaping our view hitherto,) to give the enſuing accompt of it.

The Learned Author then undertaketh in it to deſcribe chiefly the Uſes and Virtues of thoſe Simples or Plants, which growing in *Europe*, are by long Experience approved of; treating more particularly of thoſe, that grow in *Denmark* and *Norway*, which are the Countries, he is in a more eſpecial manner related to.

This Deſcription he performeth in ſuch a Method, that he reduceth the ſaid Plants to Four *Claſſes* Alphabetically, according to the Four *Seaſons* of the year, wherein they grow or are in flower; that ſo the Curious *Botaniſt* and others may know, when ſuch and ſuch Plants are to be had and gather'd for uſe. This he doth, beginning from the Winter-plants, and thence proceeding to the Vernal and Æſtival, and concluding with the Autumnal.

He inſerts in many places divers Remedies and uſeful Advices for Health: In the doing of which, and ſhewing himſelf very particularly concern'd for the cure of the *Tabes Anglica*, (the *Conſumption,*) ſo much reigning in *England*, he employeth more than one *page* in recommending to the *Engliſh* Nation (for whom he expreſſeth a ſingular eſteem) that Plant, which the Latins call *Chelidonium majus vulgare*, the *greater Celandine*, as an approved medicin and no leſs than a Specifick to cure that Diſeaſe, after the uſe of Antimonial Emeticks; teaching withall, that it is to be prepar'd and uſed, for that purpoſe, in its Tincture, together with the *Trifolium fibrinum Tabernæmontani*; and exhorting alſo diligent Anatomiſts, to open and well to examine the Liver and other *viſcera* of ſuch, as dye of this ſickneſs, being himſelf altogether perſuaded, that thoſe are the Parts, which are primarily and by *idiopathy* affected in a Conſumption, and the Lungs not otherwiſe than ſecondarily and by *conſent*; Where he alſo taketh notice, that one of the main cauſes of the frequency of this Diſeaſe among the Engliſh is, their eating abundance of ſugar and other ſweet things, which, in his opinion, do cauſe a great Obſtruction in the Liver and other Entrals, (the origin of *Conſumptions*:) which by the aforeſaid Plants is powerfully reſolved and opened. See him p. 45. to 49.

Further, amongſt many other Advices, this Author obſerveth, that there is hardly any thing more inſalubrious, than to eat freſhly gather'd Fruit, eſpecially if they were expoſed to the Sun; eſteeming, that the impreſſion, made by the Sun and the fruit, not being yet diſſipated, cauſeth ſuch a fermentation in the bloud, as is inſeparable from a Fever.

For the cure of a *Tertian* he adviſeth the Patient to take four or five drops of *Roſe-mary Oyl* in ***Carduus benedictus*** and *Fumiterry* water, and to ſweat upon it, the body having been before prepar'd by general Medicins, &c.

He omits not, upon occaſion to interſperſe very curious remarks; as that the Herb, called *Gramen Oſſifragum*, hath this property, that, if any Animal do eat of it, the nerves and tendons will be ſo relaxed, that it ſhall hardly be able to ſtir, but be as if its loins were broken: for which he thinks this reaſon may be given, that poſſibly in thoſe places, where this Plant grows, there are Mines of Quickſilver or Lead, whence it may derive this quality ſo hoſtile to the nerves. There is another particular, among many others, which we cannot leave un-mentioned, *viz.* That, whereas common Chymiſts make *Sulphur* to be the principal Cauſe of the ***Colour*** in Mixts, he rather aſcribeth it to *Salt*, (as he alſo doth *Taſt* and *Smell*;) For the proof of which he alledgeth divers reaſons, which he confirms by this Experience; That, to make Black Horſes become of a Dapple-gray, you need only give them for ſome days in the Spring a handful or two of ſmall Oak-buttons mingled with their Oats: And this change of Colour he attributes to the Vitriol abounding in Oak, and which cauſeth that cracking noiſe, which is made by that wood when put in the fire.

To all which I muſt add what he noteth concerning the Inteſtin called *Cæcum*, the Uſe of which is ſo much controverted amongſt Anatomiſts, but diſcover'd by this Author to be, that as the ***Bladder of Gall*** is the receptacle of the *Gall*, ſo this ***Cæcum*** is the receiver of the *Flatus* or winds; and that thence it is, that commonly 'tis found empty or only ſome clear water in it, which the winds have been turn'd into: Adding, that Nature hath made this Inteſtin larger in Hoggs, Birds of prey, and other Beaſts, which by reaſon of their voracity are more ſubject to crudities, and therefore to winds,&c.

He annexes to the whole ſeveral Appendixes; whereof *one* contains the *Doſes* of the received Emeticks and Purgatives both ſimple and compound; *Another* exſpatiateth into the praiſes of *Hippocrates*: The *third* conſiders the ſeveral Duties of Phyſitians, Apothecaries and Chirurgions: The *fourth* and laſt delivers a Method of making a good Herball.

ERRATA left un-obſerved in ſome of the later Tracts.

IN Numb.73.p.2197.l.2. *del.* that whole line: *that hole in ſome of the Shop-Kermes being accidental only, and ever on the bottom-part cleaving to the branch; and the time of gathering them for colour is without doubt before they are pierced, and whileſt the Animal is yet in* vermiculo, *and conſequently the Husk intire.*

In Numb.74. p.2238. l.38. *r.*h.6.37′. *ib.*l.39. *in col.*2. *r* h.5.52′.

In Numb.75. p.2244. l.3. *r.Real Infinites.* p.2245. l.8. *r.any proportion.* p. 2247. l.ult. *r. of* $14\frac{4}{14}$. p. 2248. l.36. *r. not* $14\frac{4}{14}$. p. 2269. l.36. *r. halitum meum.* p.2270. l.27. *r altit. eſt peripheriâ.*

LONDON,

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Numb.77.

PHILOSOPHICAL TRANSACTIONS.

Novemb. 20, 1671.

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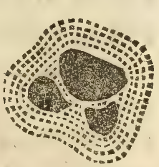
Obſervations, made by Mr. Hook, *both of the* Solar Spots *lately diſcover'd, and the* Eclipſe *of the* Moon *of Sept.* 8.1671. *Some Additions of* M.Liſter *to his former Communications about* Vegetable Excreſcencies, *and* Ichneumon Waſps, *together with an Inquiry concerning* Tarantula's. *Predictions of the Viſible* Appulſes *of the* Moon *to, and her near* Tranſits *by certain* Fixt *Stars for A.* 1672. *An Accompt of ſome Books:* I. *SHEEPS BOUW en BESTIER, that is, NAVAL ARCHITECTURE and CONDUCT, in Low-Dutch*, by N. Witſen. II. *RECHERCHES & OBSERVATIONS ſur les VIPERES, par Monſ.* Bourdelot. III. *Admirandorum FOSSILIUM, quæ in tractu* Hildesheimenſi *reperiuntur, Deſcriptio, à D.* Frid. Lachmund. IV. *De CATHARRHIS, A.R.* Lower *M.D.* V. *DELICIÆ PHYSICÆ* Goth. Voigtii.

Obſervations made by Mr. Hook, *of ſome* Spots *in the* Sun, *return'd after they had paſſed over the Upper Hemiſphere of the Sun which is hid from Us; according as was predicted* *.

A*uguſt* 30.1671. I ſaw a large Spot in the Center of the Suns face about noon, but had not then time to make any more exact obſervation thereof.

Septemb. 1, at 3 a clock I ſaw the ſame Spot moved about a quarter of the Diameter of the Sun Weſtward, and it appeared of this form exactly, that is, it conſiſted of one greater and two leſſer black Spots with a dnsky cloud incompaſſing them: The Diameter of the whole Phænomenon was about $\frac{1}{72}$ of the Diameter of the Sun, and it was diſtant from the next adjoining limb, $\frac{18}{72}$ (that is, exactly one quarter) of the Diameter of the Sun. This I examined and meaſured ſeveral times, and found very exact.



So far He. To which we hope we ſhall be able to add, by another opportunity, what hath been further obſerved abroad, as well of the *ſecond* progreſs of theſe Spots on the Sun's apparent diſque, as of the continuation of their *former* motion thereon.

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* *See* Numb.75.p.2253.

Obſervations made by the ſame, of the late Eclipſe *of the* Moon, the *8th of* September 1671. ſt. vet.

SEptemb. 8. 1671. H. 7. 27′½. I firſt obſerved the Moon Eclipſed when it began to be enlightened, the total darkneſs being already paſt: The ſhadow paſſed through the middle of the Spot called by *Hevelius* M. *Porphyrius*, half of the ſaid ſpot appearing without the ſhadow and the other half being darkned thereby.

H. 7. 49′. The ſhadow paſſed through the middle of M. *Sinai*, through the middle of the Eaſtermoſt of the three Lakes called *Mare Adriaticum*, and juſt touched the ridge of the *Appennine* Mountains.

H. 7. 54′. It paſſed the middle of the J. *Besbicus* in the *Propontis*.

H. 8. 0′½. It paſſed through the ſtreights of the *Pontus Euxinus* at the Promontories *Acheruſia* and *Ariſtes*.

H. 8. 6′½. It touched the *Palus Mæotis*, which *Palus Mæotis* was then diſtant from the limb of the Moon next adjacent one third part of its ſhorter diameter or breadth.

H. 8. 17′. The ſhadow went off the body of the Moon upon the innermoſt limb-line of *Hevelius* his large chart of the Moon at the 29 diviſion juſt without the J. *Major* of the *Caſpian Sea.* The duskiſh *Penumbra* left not the limb of the Moon quite without ſome kind of darkneſs, till 8. 29′; at which time I found that ſide of the Moon, which the ſhadow laſt left, was full as light and clear as the other.

About four or five minutes after, the ſhadow was gone off, I perceived a faint repreſentation of Colours upon that part of the body of the Moon, which was moſt affected with the *Penumbra* ſomewhat reſembling the colours of a faint *Halo* about the Moon; this grew fainter and fainter, and after a few minutes was no more viſible. It did not ſeem to be cauſed by any clouds or exhalations in the Air, the sky near the Moon being very clear, and the ſaid colours not appearing any where, but upon the dusky part of its *Phaſis*. Poſſibly it might be cauſed by the Refraction of the light from the Sun through the Atmoſphere about the Earth.

LUNÆ ad FIXAS Appulſus Viſibiles, nec non arctiores juxta eas Tranſitus, obſervabiles *A.* 1672: Prædicti, & ad Meridianum Latitudinemque *Londini*, è Tabulis *Carolinis* accuratè ſupputati à *Joh. Flamſtedio* Derbienſi-Anglo.

F*IXARUM Nomina, Loci, Latitudines & Magnitudines, quibus vel corporales Appulſus vel propinquiores Tranſitus habet LUNA Anno* 1672, *de mente & placitis Authoris* Carolini, *ſunt*;

	Fixarum Nomina.	Loci.				Latit.		Magn.
		s.	o.	′	″	o.	′	
1	*In Lino Auſtrali ♓ Lucidior. 3^{um} præcedens*	♈	9	34	48	2	11 *Bor.*	4
2	*Media & lucida Pleiadum*	♉	25	19	48	4	0	3
3	*2^{a} Bor. inter pedes ♊ & Erichtonium*	♊	23	54	48	4	6	4
4	*Borea præcedentium in □ Cancri*	♌	0	44	48	3	31	5
5	*Aſellus boreus*	♌	2	52	48	3	8	4
6	*Cor Leonis, Regulus*	♌	25	12	48	0	26½	1
7	*In ſiniſtra axilla Leonis*	♍	1	43	48	0	8	4
8	*Media in pede Leonis*	♍	16	52	48	0	33 *Au.*	4
9	*Media ſequens ſub brach. ſiniſtro ♍ infer.*	♎	11	34	18	3	23	5
10	*Auſtralis trium in fronte ♏ lucidior*	♏	28	19	48	5	22	3
11	*Quæ Cor ♏ ſequitur ad Auſtrum*	♐	6	48	48	5	50	4
12	*Septentrionalis trium in ventre ♑*	♒	8	13	48	3	1	5
13	*Duarum lucidarum in Cauda præcedens*	♒	17	9	48	2	26	3
14	*Sequens*	♒	18	55	48	2	23	3
15	*Quæ ad Clunes Aquarii*	♒	24	8	48	2	0	6
16	*In effuſione aquæ ♒ii ſuccedens Auſtralis*	♓	7	0	48	0	19	4

Anno 1672.

Januar. 4. *poſt mediam noctem ſequentem* Luna *teget ſtellam ſuperioris Tabellæ* 5^{am}, Aſellum boreum, *cujus ſub illa*

	p.m. h. ′ ″			′ ″	
Immerſio	13. 33. 43.	*Latit.* ✱^{a} *à Luna in*	*Immerſ.*	6. 0.	*Bor.*
Emerſio	14. 32. 30.		*Emerſ.*	10. 41.	
Mora	0. 58. 17.				

Januar. 27. *Sub Occaſum Solis* Pleiades *aſſequitur*; *cujus phænomeni phaſes tali ſuccedunt ordine*;

	h. ' "		✱^{a} à Centro ☽^{a}. Lat. ' "
p. m.	3. 46. 48.	*Occidentalis lucidior ſubripitur*—	6. 34. *Bor.*
	5. 2. 12.	*Eadem eluctatur*———	2. 35. *B.*
	5. 4. 54.	*Media & lucida ſubtegitur*——	6 22. *Auſt.*
	5. 48. 30.	*Infima occidentali proxima abſcond.*	9. 15. *A.*
	6. 0. 20.	*Sequens borealior abſconditur*——	15. 9. *B.*
	6. 13. 0.	*Orientalis ſuperior occupatur*——	14. 22. *A.*
	6. 15. 30.	*Media & lucida remittitur*——	10. 15. *A.*

Occidentalem, borealiorem, & orientalium lucidiorem Luna, juxta numeros Carolinos, *illibatas præteribit. Infimæ, ſequentis Borealioris, & Orientalis ſuperioris obtectiones (factâ modo de Schemate, è recentibus propriis Obſervationibus delineato, probabili aliquâ conjecturâ) diſpoſui; quarum Emerſiones, haud multo (ſperem) incommodo omiſſas, cœlum ſudum ſi fuerit, fidi Cœliſpices obſervare ne graventur, dum ipſe hujus Aſteriſmi ſtellas iterum dimetior, quò accuratiora de Phænomenis futuris, Lunæ per eas tranſeuntis, pronunciare poſſim.*

Februar. 10. *Poſt med. noctem ſequentem, vel potius* Febr. 11. *mane, abſcondet* Luna *Stellam* 11^{am} Tabellæ; *cujus erit horis diei* 11^{a} *matutinis*,

	h. ' "			' "	
Sub-ingreſſus	3. 52. 39.	✱^{a} *Latit. à Centro Lunæ in*	*Sub ingr.*	7. 21.	*B.*
Emerſio	4. 45. 39.		*Emerſ.*	10. 12.	
Mora ſub ☽	0. 53. 0.				

Maii 2. *Poſt med. noct. ſequentem, vel* Maii 3. *mane*, Luna *eandem ſtellam rurſus teget, quæ horis matutinis diei* 3^{a} *habet*

	h. ' "			' "	
Obtectionem	2. 59. 29.	✱^{a} *Lat. à Centro* ☽^{a} *in*	*Ingr.*	2. 6.	*B.*
Retictionem	4. 1. 46.		*Exitu*	1. 3.	
Durat. ſub ☽^{a}	1. 2. 17.				

Junii 18. *Sole ipſo in meridie culminante, Luna* Regulum *ſeu* Cor ♌; *ſtellam* Tabulæ 6^{tam}, *Auſtrino limbo occupabit: Quod quidem phænomenon ob plenam diei lucem inobſervabile prorſus credideram, ac ſanè ut tale omiſiſſem, ni monuiſſet* Clar. Oldenburgius, *comperiſſe* Dn. Hook, *etiam* Diurnos *Lunæ ad Fixas majores appulſus, methodo ipſi exploratâ eſſe obſervabiles;*

vabiles, taliumque Apparentiarum, ſi quando acciderent, præmonitiones identidem efflagitâſſet. Nactus igitur hoc Phænomenon (quo vel utilius, ut infra patebit è Synopſi, vel celebrius à Luna nequit unquam obvenire,) Ingenioſiſſimo Micrographo *hanc ejuſdem præmonſtrationem, gratitudinis ergò, dicatam habere, idque ipſi præ cæteris, qui obſervandi callent methodum, obſervandum committere velim.*

Reguli ſeu Baſiliſci dant Tabulæ, p.m.

	h. ′ ″		′ ″	
Occultationem	0. 11. 0.	*Lat.* ✱^{a} *à Centro* ☽^{a} *in*	*Occult.* 15. 48.	*Auſt.*
Retectionem	0. 20. 0.		*Retect.* 12. 12.	
Moram ſub ☽	0. 9. 0.			

Cordis *ad Centrum* ☽^{a} *proxima appropinquatio eſt* 15′. 39″; Lunæ *ſemidiameter apparens modò* 15′. 49″, *ita ut* 10 *ſcrup. ſecundos duntaxat à limbo Lunæ, mediâ Eclipſi, diſſita futura ſit Stella: Unde, ſi aliqua obveniat Cæli à Numeris diſcrepantia, facillimè idipſum Obſervatori innoteſcet.*

Julii 2. *Luna in* ♒ 24 *gr. Stellam teget* 15^{am} Tabulæ *noſtræ; cujus videatur ſub Luna*

	h. ′ ″		′ ″	
Incurſus	12. 49. 19.	*Lat.* ✱^{a} *à Centro* ☽^{a} *in*	*Incurſu* 0. 57.	*B.*
Exitus	13. 59. 26.		*Exitu* 4. 52.	*A.*
Mora	1. 17. 7.			

Julii 23. *Luna rurſus appellit ad Stellam* 11^{am}, *quam abſcindet h.* 10. 12′. 26″. *p.m; lat.* ✱^{a} *tum à centro* ☽^{a} 10′. 3″. *B; prius tamen ſub horizonte mergetur quàm liberet ſtellam; cujus propterea Emerſio* Americanis *conſpicienda, nobis exſpectanda non eſt.*

Julii 28. *Poſt med. noct. ſequentem, ſed* Jul. 29 *mane, Luna in* ♒ 8 *gr. abſcondet Stellam* Tabulæ 12^{am}, *cujus erit horis matutinis, diei ſc.* 29, *cum* Luna

	h. ′ ″		′ ″	
Congreſſus,	1. 29. 6. *mane*	*Lat.* ✱^{a} *à Centro Lunæ in*	*Sub-ingr.* 8. 40.	*B.*
Sejunctio à ☽,	2. 32. 4.		*Emerſ.* 2. 25.	
Mora ſub ☽,	1. 2. 58.			

Julii 29. *Nondum elapſis horis* 20. *à priori Occultatione, Luna in* ♒ 18. *gr. ſubripiet Stellam* Tabulæ 14^{am}; *cujus erit*

	h. ′ ″		′ ″	
Sub-ingreſſus	8. 32. 26.	*Lat.* ✱^{a} *à Centro* ☽^{a} *in*	*Ingr.* 0. 25.	*Auſt.*
Emerſio	9. 39. 0.		*Emerſ.* 3. 54.	
Mora ſub ☽	1. 6. 43.			

Auguſti 12. *Veſperi* Solem *in* ♍ gr. 0. 11′. 44″. Luna *teget: Eclipſis erit*

		h. ′ ″	
p.m.	*Initium*	5. 30. 16.	
	Max. Obſcur.	6. 6. 47.	*Digiti, ſummâ Eclipſi*
	Appar. Syzygion	6. 11. 39.	dig. ′
	Finis	6. 43. 20.	*deficientes* 3. 8$\frac{1}{5}$.
	Duratio	1. 13. 4.	

Octob. 23. *Veſperi Luna in* ♈ 9, *jungitur Stellæ* 1^{a}; *cujus erit*

	h. ′ ″			′ ″	
Occultatio	8. 19. 23.	Lat. *ª à Centro Lunæ in	Ingr.	2. 0.	Auſt.
Retectio	9. 32. 43.		Retect.	8. 39.	
Mora ſub ☽	1. 13. 20.				

Octob. 23. *Veſperi Luna in* ♊ 24. *gr. occultabit Stellam* Tabulæ 3^{am}, *cujus ſub Lunam*

	h. ′ ″			′ ″	
Subingreſſus	9. 21. 8.	Lat *ª à Centro Lunæ in	Subing.	5. 52.	B.
Egreſſus	10. 25. 0.		Egreſſ.	5. 15.	
Mora ſub ☽	1. 3. 52.				

Novemb. 17. *Luna veſperi in* ♓ 7. *gr. conteget Stellam* Tabulæ 16^{am}, *quam*

	h. ′ ″			′ ″	
Abſcondet	6. 25. 42.	Lat. *ª à Centro Lunæ in	Occult.	6. 15.	Auſt.
Remittet	7. 23. 25.		Retect.	12. 42.	
Retinet	0. 57. 43.				

Decemb. 22. *Luna in* ♊ 24. *gr. cum Stella* Tabulæ 3^{a}; *cujus cum Luna*

	h. ′ ″			′ ″	
Congreſſus	7. 28. 33.	Lat. *ª à Centro Lunæ in	Congr.	0. 5.	Aust.
Sejunctio à ☽	8. 31. 0.		Sejunct.	2. 20.	
Mora ſub ea	1. 2. 27.				

Preterea Februar. 23. *paulò ante mediam noctem*;
Auguſti 5. *poſt ſequentem mediam noctem*;
Octobr. 26. *ipſâ mediâ nocte*;

Et Decemb. 20. *poſt mediam noctem*; *Luna aliquas è* Pleiadibus *cooperiet*; *de quibus tamen Occultationibus certi aliquid conſtituere in præſentiarum minimè audeo*; *Eo negotio in aliud tempus* (*quando ſcil. de earum diſtantiis & locis, quorum jam obſervandorum ſatago, res certa mihi innotuerit*; *quod brevi fore ſpes est*,) *dilato. Interea* Lunæ *juxta* Fixas *aliquas Tranſitus arctiores hic adjungam, quas vigiliis noſtris haud minus dignas, ac Occultationes, arbitror.*

	H. ′ ″	′ ″			′ ″ raliori.	
Januar.	4—10.19.39.	☽ 17.47.	in conſ. *ª	4^{a}	cum Lat. 23.58.	Aust.
	7—18.34.23.	21. 3.	in ant. *ª	7^{a}	cum Lat. 17 57.	Auſt.
Februar.	25—12.13.22.	14.20.	in ant. *ª	3^{a}	cum Lat. 25.59.	Bor.
Martii	2—13. 5.30.	4.11.	in ant. *ª	8^{a}	cum Lat. 22.35.	Auſt.
Martii	4—10 51.11.	11.48.	in conſ. *	9^{a}	cum Lat. 23. 4.	Bor.
	26—13.33.11.	14 26.	in conſ. *	5^{a}	cum Lat. 28.20.	Auſt.
Auguſti	25—14.47.23.	23.52.	in ant. *	13^{a}	cum Lat. 11.33.	Auſt.
Septemb.	8—16. 6. 7.	8.12.	in conſ. *	7^{a}	cum Lat. 26. 0.	Aust.
Octob.	19— 7.37.37.	30.30.	in ant. *	13^{a}	cum Lat. 14.20.	Bor.
Novemb.	1—17.44. 7.	13.45.	in conſ. *	6^{a}	cum Lat. 20. 9.	Auſt.

Prolixiorum adeò ſupputationum proventu ita ſtrictim exhibito, reſtat, ut ordine quo ſibi ſuccedunt phænomena recenſeam: Quod dum præſtitum eo, Lunæ ſimul motus, è Tabulis ad data tempora exquiſitos, unâ eademque Synopſi adjungam, eo ſcil. fine ut ultrò eam inſpicientibus Aſtrophilis, cùm qualitates *tum* uſus *& commoda cujuſque Apparentiæ, quatenus ſcil. vel quomodo Lunæ inſerviat Motibus limandis, innoteſcant.*

Temp. apparans Londini.					Anomal. ☽æ media.				☽a ☉ pri. æquata.				Arg. Latit.				Parall. horiz.		Horiz. ſemi-d.		Horoſc. Oriens.		Altit. cent. ☽.		Ang. Paral.	
	d.	h.	'	"	s.	o.	'	"	s.	o.	'	"	s.	o.	'	"	'	"	'	"		gr.	o.	'	o.	'
Jan.	4	10	19	39	7	27	42	57	6	5	40	46	4	12	57	54			15	48	♎	1	52	49	62	14
		13	39	38	7	29	31	51	6	7	27	4	4	15	4	53	58	23	15	47	♏	6¼	59	0	84	24
Jan.	7	18	34	23	9	11	24	7	7	17	1	50	6	0	32	50	53	42	14	31	♑	5	24	51	80	59
	27	4	35	20	5	25	4	50	3	7	46	54	2	7	30	47	63	54	17	16	♌	17⅓	57	14	79	3
Feb.	10	15	53	34	0	4	6	53	9	3	53	56	8	19	57	42	50	57	13	46	♐	29½	7	24	61	12
	25	12	13	22	6	18	2	54	3	6	32	5	3	8	38	30	63	40	17	12	♏	28	22	36	45	19
Mart.	2	13	5	30	9	6	53	30	5	23	28	24	6	1	23	19	56	18	15	13	♐	11	40	0	84	17
	4	10	51	11	10	1	47	48	6	15	57	56	6	27	24	19	55	45	15	4	♏	18	26	53	45	59
	26	13	33	11	7	20	37	58	3	15	4	57	4	17	32	26	60	54	16	28	♑	5½	16	22	63	43
Mai.	2	15	15	12	11	24	31	40	6	14	6	35	8	25	57	45	52	42	14	15	♈	22	6	9	78	54
Jun.	17	23	57	19	8	0	50	0	1	14	48	28	5	16	53	31	57	55	15	38	♎	5	35	40	34	45
Jul.	2	13	5	58	2	10	57	21	7	3	32	50	11	17	15	20	55	58	15	8	♊	12	22	11	82	9
	23	10	5	37	11	13	43	50	3	24	51	50	8	28	5	54	50	57	13	46	♉	4	3	56	76	2
	28	14	15	3	1	21	19	15	5	22	44	33	11	1	15	4	53	47	14	33	♋	21	9	55	50	27
	29	8	45	0	8	1	23	50	6	1	40	11	11	11	34	18	54	46	14	47	♈	1½	8	31	78	57
Aug.	12	5	18	14	8	2	25	44	11	29	46	29	5	23	33	18	58	28	58	48	♑	19½	15	53	72	7
	25	14	47	23	1	27	25	5	5	4	35	9	11	10	27	3	55	18	14	57	♌	15	0	46	52	29
Sept.	8	16	6	7	8	1	0	31	11	4	39	24	5	27	49	2	59	45	16	9	♍	8				
Oct.	19	7	37	37	1	21	57	17	3	11	29	51	11	13	35	54	52	29	14	11	♋	11	19	18	57	58
	23	8	33	16	3	14	42	50	4	29	42	35	1	5	26	14	56	27	15	16	♋	17	41	52	83	38
	28	10	3	50	5	20	51	19	7	5	22	59	3	22	49	29	62	8	16	48	♌	7	35	4	53	48
Nov.	1	17	44	7	7	17	17	20	9	2	26	2	5	22	53	37	61	16	16	33	♏	1	50	47	56	59
	17	6	13	30	2	10	4	6	3	2	48	4	0	5	38	2	55	17	14	56	♋	9½	29	58	69	42
Dec.	22	8	36	38	5	18	42	13	5	12	48	49	3	23	30	25	61	0	16	29	♍	3½	57	3	57	1

Taceo de Phaſi Lunæ *in Umbris Terræ patientis, quippe de qua plus ſatis Aſtrologi. Interim hæc fideliter ſupputata & indigitata Phænomena cùm Illuſtriſſimæ* Regiæ Societati, *tum, Ipſius Auſpiciis, omnibus alibi Cælorum Studioſis impenſe commendo: quibus ampliſſimum Scientiæ incrementum, perennes ſtudiorum profectus, Cælumque imprimis his obſervationibus peragendis omninò propitium animitus exopto.*

Some Additions of Mr. Lyſter *to his former Communications about* Vegetable Excreſcencies, *and* Ichneumon Waſps ; *together with an Inquiry concerning* Tarantula's, *and a Diſcovery of another* Musk-ſented Inſect : *tranſmitted to the Publiſher from* York *in two Letters, of Octob.* 16. *and* 28. 1671.

The Extract of one of theſe Letters :

THat this Letter may not be without all matter of Philoſophy, you may take an occaſion to put this *Quære* to your correſpondents of *Italy*, viz.

Whether the *Tarantula* be not a *Phalangium* (that is, a ſix-eyed skipping Spider) as *Matthiolus* and others ſeem to tell us? if ſo, whether ſome later Authors impoſe not on us by giving us a Cutt or Figure of a Net or *Reticulum orbiculatum*, which our Engliſh *Phalangia* are never (that I know of) obſerved to weave or make uſe of in hunting ? and whether the perſon bit by a *Tarantula*, be not ever, when on his feet, diſpoſed to and actually dancing after the nature of a *Phalangium*, which never moves but by skippings ; even as it happens with ſuch that are bitten by a Mad Dog, who have been ſometimes obſerved to bark like a dog, &c. And if ſo, what we are to think and credit concerning ſuch and ſuch Muſical tunes, ſaid to be moſt agreeable and tending to the Cure of perſons bit by a Tarantula?

But next among other things, I had the good fortune to preſent Mr. *Willoughby* giving me the honour of two viſits, with a *Musk-Ant* * an Inſect obſerved by me not many days before his firſt viſit : And though I cannot ſend you the Inſects themſelves, as having parted with all I had, yet I will the Note, *viz.*

* *See of two or three more* Musk-Inſects Num 74. *p.* 2220. *and* Numb. 76. *p.* 2281.

Septemb. 2. I found in a Sandy Ditch-bank, the firſt hollow beyond the Ring-houſes in the high-road to *London* about a mile and an half from *York*, a ſort of exceeding ſmall *Piſmires* (by which note alone I think they may be ſufficiently diſtinguiſh't from all at leaſt that I have ſeen.)

Thoſe *without* wings were of a light-yellow or flaxen, and being broken at on's noſtrils they emitted, like others, an acid or ſowre ſent; but thoſe of the ſame bank *with* wings, were cole-black, aud theſe, bruiſed and ſmelt to, emitted ſo fragrant a ſmell like *musk*, that I muſt confeſs they were too ſtrong for me to endure: yet having kept them ſome time by me, the more delicate ſex were not diſpleaſed with the ſmell. And an Apothecary in this City, famous for his diligence in Chymical Operations, did compare them (unſeen and not yet made known to him) to an excellent balſom, he is wont to prepare.

Mr. *Willoughby* inform'd me, that he had found the *Goat-chafer* or *Sweet beetle* * out of ſeaſon as to that ſmell; and thereupon asked me, what I had obſerved as to the time of their ſweeteſt and ſtrongeſt ſmelling? I anſwer'd, that I believed it to be at the time of the *Coit*, for aſmuch as at that time, when I took them highly perfumed, I had obſerved the female full of Egg.

* *Of which ſee* Numb. 74. p. 2220. *and* N. 76. p. 2281.

The Extract of the other Letter:

I Send you a ſecond paper about *Vegetable Excreſcencies*; the ſhortneſs of the former * and ſome things therein, perhaps liable to Exception, obliging me thereto.

* *Of which ſee* Numb. 75. p. 2254.

Concerning the fifth and laſt propoſition of the *firſt* paper, it might be more intelligibly expreſſed thus, *viz.* That the ſubſtance or *fibrous* part of *many* Vegetable Excreſcencies *ſeems* not to be the food of the worms found in them: My meaning is, that the worms in thoſe Vegetable Excreſcencies, which produce *Ichneumons* (to which kind of Inſect we would limit this propoſition, and therefore expunge all other inſtances,) theſe worms, I ſay, do not ſeem to devour the ſubſtance or fibrous part of them, as other worms eat the Kernels of nuts, &c. but that (what-ever their manner of feeding is, and we doubt not but that they are nouriſh't in and upon ſome part of them,) the Vegetable Excreſcencies ſtill mightily increaſe in bulk, and riſe as the worms feed.

It is obſervable (to endeavour a Solution) that ſome of the *Ichneumons* delight to feed of a liquid matter, as the Eggs of Spiders, the juices (if not Eggs) within the bodies of Caterpillars and Maggots: Whence we conjecture, that thoſe of the ſame *Genus*, to be found in Vegetable Excreſcencies, may in like manner ſuck-in the juices of the equivalent parts of Vegetables. And *this* the dry and ſpongy texture of ſome of thoſe kind of Excreſcencies ſeems to evince: For, if you cut in pieces a *Wild-poppy-head*, for example, (or the great and ſoft balls of the *Oak*) you'l find in thoſe partitions, wherein theſe worms are lodged, nothing but a pithy ſubſtance like that of young Elder; and if there chance to be any cells yet unſeiſed, (which I have ſometimes obſerved) the ſeeds therein will be found yet entire and ripe. Whence very probably they feed upon or ſuck-in by little and little the yet liquid pulp of the tender ſeeds, and leave the ſubſtance or fibrous part to be expanded into an Excreſcence.

As for matter of Fact, to clear the truth of that opinion, that the divers races of *Ichneumons* are generated by their reſpective Animal-parents, and particularly that thoſe, which the divers Excreſcencies of Vegetables produce, are not *plantigenous*, I am in great hopes, the inſtance of *Poppy heads*, ſwoln into Excreſcencies, will favour us the next ſeaſon. My expectation is chiefly grounded upon the condition and nature of that plant; which is ſuch, that nothing can pierce the skin of it and wound it but it muſt neceſſarily leave a mark of its entry, the milky juice ſpringing upon the lighteſt puncture, and drying and *concreting* ſuddainly into a red ſcar: And this, I think, I may affirm, that of the many heads grown into Excreſcencies, which I gathered this Summer, all had more or leſs of thoſe marks upon them. But our aim is here only to make way for the Obſervation againſt the next ſeaſon; to which purpoſe alſo we propoſe the following *Quære's*;

1. Whether the ſhagged balls of the *Wild Roſe* are not Excreſcencies grown from the bud and very fruit of the plant; like as the *Wild-Poppy*-heads are apparently not for worms but ſeed.

2. Whether the large and ſoft balls of the Oak are not in like manner the bud and acorn with all the parts of a ſprouting branch, thus monſtrouſly perverted from the firſt deſign of nature?

3. Upon what parts or juices the *Ichneumon*-worms, ſuppoſed to be thruſt into Caterpillars and other Maggots, can be thought to feed: And whether there be not actually Eggs in Caterpillars and Maggots (as there are to be obſerved in their reſpective *Chryſalis's*) ſufficient to ſerve them for food?

Concerning the name ἰχνεύμων, although I could willingly refer you to Mr. *Ray*, who is another *Heſychius*; yet for preſent ſatisfaction I ſhall tranſcribe what the Excellent Critique G. *Voſſius* ſaith (c. 16. *de Inimicitia*;) *Ichneumon* (i.e. *Mus Pharaonis ſive Ægyptiacus*) *Crocodili & Aſpidis ova indagat, unde illi* Ichneumonis *nomen, quaſi dicas* Indagatorem (ἀπὸ τοῦ ἰχνεύειν:) *Reperta utriuſque ova conterit; ut eſt apud Oppianum in 3o de Venatione: Nicander tamen ait, eum Aſpidis ova humi mandare.*

Now a like Obſervation of certain Inſects of the Waſp-kind, made no doubt by ſome of the Antients, occaſioned the application of that name to *Waſps* as well as to that *Ægyptian Mouſe*. Yet cannot I remember to have met with in any of the Antients of more than one text concerning thoſe Waſps; viz. *Ariſtot. de Hiſt. Anim. l.* 5. *c.* 20. which *Pliny* (vid. lib. 11. c. 21.) hath rendred, in a manner *verbatim*, thus: *Veſpæ, quæ* Ichneumones *vocantur* (*ſunt autem minores quàm aliæ*) *unum genus ex araneis perimunt, phalangium appellatum, & in nidos ſuos ferunt; deinde illinunt, & ex iis, incubando, ſuum genus procreant.*

How far this relation is true, and agreeable to modern Obſervations, we ſhall have perhaps occaſion to diſcourſe of elſe-where; Our deſign here is only to tell you, that we have enough to make us believe, that thoſe very Inſects, we have been treating of, are, for kind, the *Ichneumons* of the Antients.

An Accompt of ſome Books.

I. *SCHEEPS-BOVW en BESTIER, that is, NAVAL ARCHITECTVRE and CONDVCT*; *by* N. Witſen, *printed at* Amſterdam, 1671. *in Fol.*

THe Ingenious and Induſtrious Author of this Work having conſidered with himſelf, that his Country-men, though ſo flouriſhing in Navigation and Naval Architecture, had yet publiſhed nothing of that ſubject, except what *De Heer Tjaſſens* had written of the *Politie* of Shipping, did reſolve with himſelf to break that ſilence, and to communicate unto the World a Hiſtory both of the *Ancient* and *Modern* way of *Building, Equipping*, and *Governing* of Ships; which deſign having been by him put in execution in this Book, he therein largely treateth not only of the Manner of the Naval Architecture uſed by the *Greeks* and *Romans*, together with their Naval Exerciſes, Battles, Diſcipline, Laws and Cuſtoms; but alſo of the Method and Way uſed at this day both in his *own* Country, *England*, *France*, and the *Indies*, together with the difference there is between the Manner of Building Ships, practiſed by *Others*, from that of the *Dutch*, and particularly of the *Indian* way of Equipping their Ships, and the manner of Building Galleys: All inriched with an ample Seamans Dictionary, and a great number of Illuſtrating Diagrams.

The whole Work is divided into Two main Parts; The *Firſt* contains XIX Chapters; whereof,

1. Giveth an account of the firſt Builders of Ships, and in general of the Building of the Antients, both before and after the Deluge; where the Author particularly diſcourſeth of *Noah's Ark*; of divers Ships found deep under ground; of the ſtructure of the Ship *Argo*; of the Navigation of the *Phenicians, Rhodians, Corinthians, Ægyptians, Tyrians, Cretians*, &c.

2. Delivers the Way of the Naval Architecture of the *Greeks* and *Romans*, both for War and Commerce, together with the manner of Equipping their Ships row'd with Oars, both of ſingle and manifold ranks, and the fitting of the Rowers:

Where he treats of the *Biremis Piſtrix*; the *Biremis Vallata Oneraria Cerealis Siracuſia*; the *Biremis* and *Tiremis turrita*; the *Triremis vallata*, &c.

3. Diſcourſeth of ſeveral ſorts of the Ancients Structure of Ships, and chiefly of the great Veſſels built by *Philopater* and *Hiero*, the pompous make of both which is here repreſented; as alſo of the numerouſneſs and launching of their Ships.

4. Enumerateth divers un-common Obſervables in Ships both of Ancient and Later times, as in *Noah's Ark*, the Ships of *Argo*, *Theoris*, *Paralon*, *Salamine*, *Magellan*, *Drake*, &c. To which he adds that Noble Fregat built in *England* A. 1637. called the *Soverain*, of 1637 Tuns, having a keel that was to be drawn by 28 oxen and 4 horſes; as alſo a Deſcription of the *Spaniſh Armada* of 1588, called the *Invincible*; not forgetting the *Bucentoro* of the *Venetians*; nor the *Mageleza* of the *Suedes*, a Man of war, appearing at Sea about 100 years ſince, and having ſides of that thickneſs, that all bullets ſtuck within her boards. In this Chapter is inſerted a Relation of a Ship found in the time of *Pius* II. in the *Numidian* Sea, 12 fathoms under water, 30 foot long and of a proportionable breadth, built of *Cyprus* and *Larix* wood, and reduced to that hardneſs, that it would hardly burn; as it was alſo very hard to cut: No ſigns in it of any rottenneſs any where; its deck cover'd with paper, linnen and leaden plates, faſtned with guilt nails, as alſo were the boards; the whole ſhip ſo cloſe, that not a drop of water was found ſoaked through into any cloſe room. The Author concludeth it to have lain there about 1400 years.

5. Relateth, what great Fleets were anciently ſet out, and what far voyages undertaken: where he taketh particular notice of the Expedition of the *Argonautes*, of *Xerxes*, of *Alexander M*, of *Rome*, and *Cartage*, of the *Saxons*, *Britons*, &c.

6. Deſcribeth what the Antients obſerved in Building their Ships, and how they cloſed, rigged and beautified them; where occur ſeveral relations of divers ways of cementing, caulking, pitching, and defending ſhips from rottenneſs and worms; of which I ſhall only mention, what occaſionally he alledgeth of a certain cement now uſed by the Indians, made of finely beaten reeds, chalk, and oyl, with which

their Ships are over-laid to keep them from rotting.

7. Rehearſeth the State of Naval Architecture after the Ruine of the Roman Empire; eſpecially amongſt the *Scyhians*, and *Saracens*, invading *Italy*, *Spain*, *France*, &c; together with the endeavors of the *Romans* under *Juſtinian* and others, to defend themſelves againſt thoſe *Barbarians*: Not omitting, what was done by the *Danes*, *Huns*, *Engliſh*, *Saxons*, and particularly by that Brave and Vigilant King *Edgar*, who maintained a Fleet of 3600 ſail, which he divided into three Squadrons, called the Eaſtern, Weſtern and Northern, ſailing in them himſelf every year round about *England* and *Scotland*. To this he annexeth, at what time Shipping was at the loweſt ebb, and how it began to be reſtored by ſome Kings of *Portugal*, the *Frieſlanders*, and his Countrymen in general, about 200 years ſince.

8. Giveth an ample and very particular account of the preſent way of Building Ships, both for War and Trade, in *Holland*. Where are repreſented not only the Parts of a Ship in their ſeveral Figures, together with their Names, and Uſes; but alſo a whole Ship, perfectly rigg'd, and on it the parts marked, with reference to the annexed Diſcourſe, wherein they are deſcribed.

9. Contains a particular Deſcription of the Proportions of all the Parts of a Dutch ſhip, and the Meaſures of ſome peculiar ſorts of Veſſels of that Country: Where he inſtanceth in ſeveral Ships of different lengths, as of 134, 160, 150, 140, 125, 130, feet long; as alſo in a Frigot, 130 feet long; and aſſigneth the meaſures and proportions of the reſpective parts thereof: Adding withall an account of divers Frigots and other Ships, there built by ſome of their moſt famous Shipwrights, to the number of *Twenty ſix*.

10. Declareth the Make and Weight of all ſorts of Ankers, and the bigneſs and weight of Cables in general, and in particular of certain Ships built there; as alſo the meaſures and proportions of Maſts, and Sails, of divers Veſſels, and how Sails may be beſt ordered to take in moſt wind, mathematically ſhown: Where Occaſion is taken to inſert conſiderable remarks about the ſeveral ſorts of Hemp, and the beſt way of

working Cables, and the care to be had in the manner of tarring them, and in the degree of heating the tar for that purpoſe,&c.

11. Delivers the Method of conjoyning the parts of a Ship one after another, uſed by *Dutch* Ship wrights; together with a repreſentation of a Ship upon the *Stocks*, and their manner of *Launching* ſhips: Adding their way of redreſſing a ſhip that lieth on her ſide, as well as of laying her on her ſide for repairing or cleanſing; and intimating alſo, that amongſt them a ſhip 180 or 185 feet long, can conveniently be built up, by 50 men, in 5 months; and that the charges of building a ſhip, 165 feet long, 43 feet broad, and 31 feet high, built of the beſt timber, amounts to 74152 gilders; beſides its iron-work, which together with its rigging comes to 19483 gilders more, without the warlick equipage: Judging withall, that ſuch a ſhip, well built and kept with care, may laſt 20,30, 40, to 50 years; mentioning alſo, that he had ſeen a certain *Engliſh* veſſel, of 70 years old, and not yet altogether uſeleſs.

12. Speaks of the meaſures and proportions of ſeveral other Sea-veſſels, that are of a ſtructure and uſe different from that of the former; ſuch as are Flutes, Green-land-veſſels for Whale-fiſhing, Advice-yachts, Boyars, Galliots, Fire-ſhips, Pinks, Buſſes,&c.

13. Treats of other ſorts of Veſſels, as Coaſters, Yachts, Challoups, Lighters, Boats, Skiffs, Double-bottom'd Veſſels, ſhips riſing without being unladen, and ſuch as move under water, or againſt the ſtream, and eſpecially of a Veſſel uſed at *Amſterdam*, whereby in one day may be fetch't up 50 or 60 boats of mud, performed by the means of a big wheel and large ſpoons. In the ſame *Chapter*, inſtructions are given concerning the Choice of Ship-Timber; where are to be found many neceſſary and very uſeful Obſervations and Directions relating to the purpoſe in hand,and a particular commendation of the *Engliſh* and *Iriſh* Oak for ſhips. To all which is added an Enumeration of all ſorts of Tools and Engins requiſite for this kind of building.

14. Conſiders the Structure of *Galleys* and *Galleaſſes* in particular, and what is peculiar in them and different from other ſhips; taking alſo notice in brief of *Galeaſſes, Brigantines, Feluccas*, &c.

15. Diſcourſeth of the Proportions obſerved by the *Engliſh* and *French* in the building of their reſpective ſhips: Where he taketh ſpecial notice of Four Frigats of four diſtinct rates; exhibiting and deſcribing them as they are to be found in the Duke of Northumberland, *Robert Dudley*, his *Arcano del Mare*, printed at Florence; and concluding this *Chapter* with a deſcription of the Frigat called the *Royal Charles*, (ſome years ſince fallen into *Dutch* hands,) and an Encomium of the *Engliſh* Orders at Sea.

16. Maketh a Narrative of the *Indian* way of framing ſhips: Where firſt of all occur the *Canoe's* and their Structure out of one only Tree, hollow'd by burning. *Next*, the *Chineſe Yonks* of *Nankin* (a ſort of flat-bottom'd Boats,) and other Veſſels of the ſame Country; among which thoſe are deſcribed, that are as big as little Iſlands, and hold many houſes and families, floating upon the waters, and going up and down through all the parts of *China* that have the conveniency of navigable rivers: To which is added a deſcription of a Royal *Chineſe* boat, of a Serpentin ſhape, ſent to receive the Dutch Ambaſſadors in thoſe parts. *Then* the ſhips of *Malabar, Ternate, Sumatra, Japan, Terra del Fuego*, (in which laſt are made very artificial boats of the Barks of the thickeſt Trees, as in *Malabar* ſome are made of large Canes, called *Bambu*;) Moreover of *Borneo* and *Calecut*. After this, the Author returns to *China*, and relateth, that ſhips are found there, which upon rollers ſail over Land; and giveth a large account of the vaſt number of ſhips, both warlike and markantile, maintained in that Empire; together with the odd Architecture of the ſame, and the skil of that people in Navigation; as alſo an intimation taken out of *Martinius*, touching the Ancientneſs of the Chineſe Shipping, and their Colonies found ſetled in *Madagaſcar*, and their Sailing in old times even as far as to the *Red Sea*. He concludeth this *Chapter* with deſcribing the ſhips of *Madagaſcar, Bengala, Macaſſar, Siam, Pegu, Maldives, Ormus, Congo, Ruſſia, Lapland, Virginia*, &c.

17. Demonſtrates, how much weight of water there lieth againſt a Ship moving at Sea; having firſt laid down certain propoſitions made out by *Stevinus* in his *Hydroſtaticks*; which Writers foot-ſteps our Author acknowledgeth to have follow'd herein. Beſides he examins alſo the Center of Gravity of a Ship; which being known, it may be certainly concluded, How a Ship is to lye upon the water, and how heavy it is when 'tis floating, whether loaden or unloaden. Laſtly he imparts the way of the Excellent *Hudde*, of calculating exactly, what burthen a ſhip can carry either in Salt or Sweet water? Where he alſo examins the weight of the water, in which a Ship is floating; for which purpoſe he cauſed to be made a *Cube* of Copper-plates, of half an Amſterdam-foot a ſide, fitted after a certain manner, too particular to be here related, whereby he found, that upon the 15*th* of *March*, a foot of *Rain-water* weighed 49 *lb.* 14½ ounces; and *Y-water*, 46 *lb.* 2⅛ ounces; and *Texel-water*, 46 *lb.* 9 ounces. To all which he adds the way of meaſuring the Quantity of a Ship's burthen, that hath been agreed upon between the King of Denmark and the States of the United Provinces; as alſo ſeveral ways of doing the ſame, uſed by other Nations, and particularly that of the *Engliſh* and *French*.

18. Explains and gives reaſons for the ſeveral ſizes and ſhapes of the parts of a ſhip; as why the Maſts ought juſt to be of ſuch a bulk and height? Why ſome of them muſt incline backward, ſome ſtand upright? Why a ſmall Rudder can turn a great Ship; and a little Anker ſtay it? What maketh Ships not feel the Rudder? Why Veſſels too broad are weak and prove inconvenient in high Winds? Why long and moderately narrow Ships endure the Sea better, than ſhort and broad ones? How the Keel ought to be placed? Why *Gallions* and the parts of them are fram'd as they are? Why a Ship is to be broader before, then a baft? That Fregats, built long, narrow and low, ſail beſt. What hinders well-ſailing? Why Turkiſh Veſſels are excellent Sailers? And many queſtions more, conſidered by this Author.

19. Reckons up the particulars of the looſe *apparatus* neceſſary in a moderately far Voyage for an hundred men, in a ſhip 134 foot long, both for her conduct and defence, and the Food of the Marriners.

And ſo much of the *Firſt* Part of this Book.

The *Second* part comprehends the EQUIPPING and Conduct of Ships, and Navies, as well by the Antients as Moderns; couched in IV. Chapters.

1. Diſcourſeth of the Equipping and Ordering of Ships and Sea-men, practiſed by the *Greeks* and *Romans*; as alſo of the Old rights and Laws of Marriners, their Victuals, Encouragements, Puniſhments, and Arms, together with their manner of Fighting, and Triumphing upon a victory obtained: where are related ſeveral Sea-battels and their Events; as alſo divers famous Pirats, recorded in the Roman Hiſtory.

2. Deſcribeth the preſent Conduct and Government of the States General of the United Provinces in their Warlike Fleets; together with their Orders for Convoy-ſhips. Where are inſerted the particular Commands and Inſtructions given by the ſaid States in the late War between England and that Republick; as alſo their Placaet concerning *Prizes*. To all which is ſubjoined the Ship-maſters and Stiermans way of diſciplining the Sea-men, and the manner and form of commanding them to perform their part according to the ſeveral occaſions at Sea. Which Chapter is concluded with ſeveral remarks concerning the *Load-ſtone* and the *Sea-Compaſs*, and eſpecially with what care the Needle for the Compaſs is to be touch't by the Magnet.

3. Obſerveth the Ordering of Merchant-ſhips, and the Conduct of Admiralties; as alſo how they man and arm their Trade-ſhips in general, and in particular thoſe that navigate Nord ward, and their Herring-Buſſes; as alſo thoſe that ſaile to the Mediterranean. Further, how things are managed amongſt them on Ship-board, in reference to the Seamen, Officers, Souldiers, &c. in their Navigation to the Eaſt and Weſt-Indies, Greenland, &c. In this *Chapter* 'tis alſo repreſented, what benefits redound to a Country by Shipping, as to the increaſe both of its Power and Wealth.

4. Contains a Sea-Dictionary, explaining the Names of the parts of a ſhip, and the words and phraſes uſed among Seamen for all ſorts of naval concerns.

II *RECHERCHES & OBSERVATIONS ſur les* VIPERES, *faites par Monſieur* Bourdelot. *A Paris*, 1671. *in* 12°.

THis ſmall Diſcourſe is an Anſwer to a Letter, which the Excellently Learned Author had received from Signor *Redi*, Firſt Phyſitian to the Great Duke of *Florence**. In it Monſ. *Bourdelot* declares, that though Signor *Redi's* Letter do not finally decide the matter in queſtion, yet it is very uſeful to the farther knowledge of the nature of Vipers by the particularities by him recited. The controverſie being, whether the *Jellow* liquor about the long and crooked teeth of vipers are, even when they are not irritated, venomous; (which is affirmed by Signor *Redi*,) or, Whether it be a ſimple innoxious *ſaliva* or ſpittle, as is maintained by Monſieur *Charas*: This Author obſerveth, that that liquor controverted is not *yellow* in *French* vipers, as 'tis in thoſe of *Italy*: Which remark he makes uſe of to the advantage of the often mentioned *Redi*, who would reconcile theſe two opinions by ſuggeſting, that the Vipers of *Italy* and *France* are differently diſpoſed; countenancing this Obſervation with what he hath taken notice of, that the venom of the *Lues Venerea* is much more maligne in hotter than colder Countries; and alſo with what is conſtantly related by Voyagers, *viz.* that Animals are more venomous in *Africa* than elſewhere. But that notwithſtanding this, the Objection made by M. *Charas* ſeems not cogent, when he ſpeaks of a Vipers teeth, whoſe bite prov'd not mortal, although that teeth had been rubbed off and perfectly dried with bread crums; whereby he would ſupport that Experiment, in which he cauſed to be bitten and killed 7 or 8 animals one after another, of which the laſt bitten died firſt; it ſeeming impoſſible to him, that there ſhould be remaining any of that ſalival Juice about his teeth after ſo many bitings; and that therefore, to give a cauſe of that death, recourſe muſt be had to the fierceneſs of the ſpirits, tranſmitted to that crooked teeth, to be revenged of thoſe, againſt whom theſe beaſts are provoked; which angry ſpirits being thruſt into the fleſh and veins do infect the ſpirits and blood of thoſe that are bitten. To which our Author anſwers, that 'tis hard to

**Of this Letter, being printed, an Accompt was given in* Numb. 66. p. 2036. *of theſe Tracts.*

maintain, that the vindicative Spirits can paſs through a body ſo ſolid, as Teeth are, eſpecially ſince the *little* teeth have been found by Experience to cauſe as dangerous effects, as the *great* ones, after that theſe had been broken out: And that therefore it may be juſtly doubted, whether by the ſaid bread-crums all the ſalival liquor about the teeth of an animal alive could be taken away; as it may be truly affirmed, that the Vipers-teeth are inceſſantly plunged into their ſheaths, and do there continually fill themſelves with the ſaid Juice.

But he eſteems withall, that in hot Countries this liquor may work alone, when conveyed into our fleſh by the teeth of a dead Viper, or even with an Ear-picker, into a wound; as it comes to paſs in *Italy* and in hot Countries; but in *France* and in colder parts, eſpecially ſuch vipers being uſed as are kept in tuns and brought from a far off, the ſaid juice not being ſtrong enough alone, needs to be made keen by the bilious breath of the angred Viper.

And here the Author exſpatiateth into a diſcourſe, to ſhew, that without recurring to a vindicative ſpirit, paſſing through a ſharp teeth as through a needle, the cholerick breath of an incenſed viper may exceedingly invigorate that liquor, and prove a ferment to the ſame, like ſome *Afflatus malignus & Halitus teter*. Where, among other particulars, he ſpeaketh of a Gardiner, who upon the grafting of his Trees, never found more than half the grafts to thrive; of which at laſt this cauſe was diſcovered, that he ſtill took together two grafts to inoculate, of which he firſt grafted that which he held in his hand, and then the other which he held in his mouth, which having rotten teeth, did taint the ſweetneſs of the vegetative Juice in the ſecond graft, which was always found wither'd away. To which he adds, how certain breaths of wind corrupt meat, eſpecially when it thunders and lightens; how the exſpirations of ſome men and animals, when corrupted, do the like; and that one may be particularly ſenſible of the breath of a man in choller, and that the bite of a redhaired perſon is venomous; moreover, that if a man having waſhed his mouth with vinegar breaths into a bottle, the wine put into it will ſowre, and that a butchers boy having eaten oignons and garlick, or having rotten teeth, the beef or mutton by him blow'd upon the night before, will be livid next morning, and worth nothing, &c. He mentions likewiſe an Experiment, by him intended to be made, of putting ſome of the foming of a mad dog into the wound of a ſound dog, to ſee whether that will make him mad alſo, and whether it be not the breath of the biting dog, which by its agitated ſpirits cauſeth that commotion of madneſs. Whereupon he obſerves further, that the breath coming from the ſpongy Lungs of vipers enraged, is of greater force then all thoſe he hath ſpoken of, and that 'tis full of bilious ſpirits when they are angred. Where he examins, whether *Vipers* have a paſſage aſcending from the Bladder of Gall to the throat, as he affirms he hath found in *Snakes*, and particularly in thoſe of the *Grotta dei Serpi* near *Bracciano*, famous for curing ſtubborn maladies by big ſnakes winding themſelves about the bodies of the ſick expoſed there; of which he affirms to have ſeen the Experiment himſelf.

He concludeth the whole with obſerving, 1. That as Vipers are eaſily provoked, ſo they are very gentle when their bile is not agitated; and that it may be ſaid, they know thoſe that tend them, who take them out of their tuns with whole handfulls innoxiouſly. 2. That Vipers do exceedingly abound in Spirits, whence they are ſo proper to reſtore the aged, and to prolong their days; and that the heart or liver of a viper is one of the greateſt Alexitery's in the world, and admirably efficacious in malign fevers.

We muſt not omit to take notice here, that this Author p 17. 18 mentions, that the Gentlemen of the *Academy of England* (for ſo he is pleaſed to call them) do aſcribe the venom of *Waſps* and *Bees* to the *Laceration* that is made by the ſtings of thoſe creatures.

Whom he means by this *Academy*, we know not, unleſs it be the *R. Society*, who yet never publiſh't any thing as theirs, whether of this or any other kind. If he mean the *Micrography*, compoſed by M. *Hook*, a Member of that Body, the contents of that book, however licenſed by that *Society* as ingenious, or of any other, thus honoured, ought by no means to be taken for the ſenſe of that Body. But neither does that Book affirm any ſuch thing, but plainly obſerves, that the ſaid laceration of the ſtinging animal is follow'd by a virulent liquor which is there made the cauſe of the troubleſom effects,that enſue. So that the ſenſe of this part of the *Micrography*, (if that be pointed at) hath been ill interpreted and repreſented to our Author ; who (not to leave that unmentioned) promiſeth to publiſh ſomething, wherein he means to ſhew, that there are many Inſects, which moſt aſſuredly are not bred by an Egg: Which piece the Curious are very deſirous to ſee.

III. *Admirandorum FOSSILIUM, quæ in tractu* Hildesheimenſi *reperiuntur, Deſcriptio, Iconibus illuſtrata, à D.* Friderico Lachmund, *Hildesheimi*, 1669. *in* 4°.

THis Deſcription containing ſeveral things, that may increaſe the Materials for an Hiſtory of Nature, (the compoſure of which is now almoſt every where endeavoured after;) we thought fit, among other Writers of this kind, to take notice alſo of this Author, who delivers what he hath met with in the Country above-mentioned in four Sections.

In the *Firſt* he diſcourſeth of the *Earths* there found, as Marles, Clays, Fullers Earth, Tripoli, Black Chalk, a Vermilion Earth, (melting like butter upon the tongue) and Oker.

In the *ſecond*; of *Concrete Juices*, as Salt, Niter, Alum, Vitriol, Sulphur, Bitumen; and this latter, (to which he refers the *Succinum* or *Amber* ſo copious in *Boruſſia*,) he ſaith is there digged out in a certain hill, called *Deſter*.

In the *third*; of *Stones*, eſpecially Spars, Touch ſtones, Marble, the *Lapis Specularis*, Blood-ſtone, *Schiſtus*, *Lapis Samioides*, Chryſtal, *Brontia* and *Ceraunia* (vulgarly called Thunder-ſtones,) ſeveral ſorts of *Belemnites's*, ſome of which being rubbed ſmell like burnt Horn ; Eagle-ſtones ; *Cornu Ammonis* ; various ſhells petrified ; *Trochites's*, which being put in vinegar raiſe bubles like the *Aſtroites* ; Stones repreſenting Flower de Luces ; divers Angular ſtones ; Stones reſembling Trees ; a foſſil Ebony ; whole Columns of dropping lapideſcent water congealed, of the thickneſs of a man ; *Oſteo colla* growing in a ſandy ground, ſometimes like coral, and at its firſt coming out of the Earth friable, but by degrees growing hard ; foſſil Unicorn and Ivory, commonly hard without, but within ſoft and friable, ſticking cloſe to the tongue, and of a pleaſing ſent:

To all which is added an enumeration of variouſly ſhaped Stones, found in the bodies of Men and Women ; among which there is mentioned one, which being taken out of the cheek of a woman, was found to be a Cherry-ſtone, round about incruſtrate with ſtony matter, the Cherry being ſuppoſed to have been forced into the Cheek by a fall, and *there* in proceſs of time thus cruſted over, as hath been ſaid ; as alſo very many ſtones come out of the corner of a young Womans Eye.

In the *fourth*, of ſome uncommon *Springs*, among which are related ſome ill ſenting, and deadly Springs, whereof one is mentioned ſmelling like rotten Eggs ; and another, in which, when cleanſed and renewed, four workmen were killed by its noiſom exhalations, &c.

IV. *De CATARRHIS*, *A.* Rich Lower *M.D.* *in* 8o.

WE mention this Book only to give notice, that 'tis now printed by it ſelf in *England*, to be found at Mr. *Martyn's* Stationer at the *Bell in Pauls Church yard* ; referring the Reader for the account of the Contents thereof to *Numb.* 73. where it was ſpoken of, when we ſaw it printed in Holland, together with the Authors Book *De Motu Cordis & Sanguinis*.

V. Goth. Voigtii *DELICIÆ PHYSICÆ* : Roſtochii *A.* 1671. *in* 8o.

THis Author entertains his Readers with divers curious ſubjects, ſuch as are the Bleeding of perſons killed, at the preſence of the Murtherer ; the Tears of Crocodiles ; the Licking of new whelp'd Bears by their Dams ; the Love between Wolves and Sheep ; Foſſil Fiſhes ; the Caſting of Horns by Dear, &c.

As to the *firſt* of theſe, he ſhews it to be a very dubious and dangerous inference, to conclude a perſon guilty of murther from the eruption of the blood of the ſlain ; ſince that *both* a ſufficient natural reaſon may be given for ſuch bleeding, whoſoever be preſent ; *and* examples are extant of ſuch an effect, when yet the moſt innocent were by, even a Bridegroom ſitting by his dead Bride, when the blood burſt out of her body.

The *Second* argument is reſolved by diſtinguiſhing meer Moiſture or aqueous drops from *Tears* properly ſo called; which latter this Author adſcribeth to *Rational* creatures alone, as only capable of true grief.

The *third* Inquiry, whether the whelps of Bears are born unſhapen and imperfect; is here anſwer'd in the *Negative*, thoſe young creatures being in truth found no more unfaſhioned and defective in their kind, than others in theirs ; and the licking of the ſhe-bear being common to her with other animals, that do the like to their young ones.

The *Fourth* is ſo determin'd by this Author, that he pronounceth the wolve's tearing and devouring of ſheep to proceed not from Sympathy or Love, but from the Contrary ; it being found, that Wolves often worry many more ſheep, than they can devour ; there appearing alſo a manifeſt averſion betwixt them from the ſheep's flying away from wolves,inſtead of which there would be a conſociation,if there were a ſympathy betwixt them. Where a particular Example being recited of a Wolf keeping and defending ſheep ; the thing is attributed to their being bred and fed together,and not to any natural Love.

Concerning the *fifth,*'tis here affirmed, that there are Fiſhes under ground and in mines where waters are found , which may either be naturally met with amongſt earth,or conveyed thither by various accidents,inundation of rivers,abſorption of rivers,earth-quakes, &c. Where ſome relations are inſerted of odd things found under ground ; as of a whole ſhip fit to ſail in the Sea,ſound A.1594.near *Maeſtrich* under a ſandy hillock ; and of another very old ſhip,found by mine-men A.1462. not far from *Berne* in *Helvetia* under ground, together with its hempen ſails and anchors, &c ; as alſo ſtore of Pine-trees,found in the *Peele* orderly placed under the Earth, which elſe grow in raiſed ground.

Touching the *Sixth*, viz.the Caſting of Horns by Staggs, 'tis here diſtinguiſhed,that Caſtrated Staggs do not caſt their Horns, but Entire ones do ; yet not ſo, as that theſe latter are by good experience known to caſt them every year,though it be generally ſaid and believed that they do ſo; whereas in the mean time 'tis commonly held,that every year in the firſt ſix years ſome addition is made to the branched Horns ; unleſs that be to be underſtood of a greater number of branches,growing every year, for ſo long a time, inſtead of the leſſer number caſt off.

Of this *Caſting*,the Cauſe is alſo here inquired,ſome adſcribing it to ſuch a cauſe, as maketh Leaves fall from Trees,by reaſon of the want of a glutinous moiſture ; others imputing it to their too great Hardneſs, hindring the diffuſion of the copious affluent blood , out of which,being gathered about Autumn,worms in time are bred, which gnawing and thereby exciting the itch make the *animal* rub off its horns againſt ſome Tree ; others refer it to both,as our Author.

Laſtly,of *Falling Stars*,vulgarly ſo called, they being in truth nothing but a Meteor : touching which this Author diſcuſſeth ſeveral Queſtions ; as,How it comes to paſs,that at times the True Star, under which the trajection happens, doth not preſently appear ? Whether thoſe Trajections of Stars do alſo happen in the day time? Why thoſe Stars when they fly through the Air, ſeem to repreſent a long courſe ? why the motion of Falling Stars is ſlower at the latter end ? &c.

ERRATA.

In *Numb.*74.p.2238.l.24.read,*ninth of Auguſt v.ſt* not *n.ſt.*

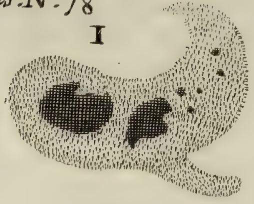
LONDON,
Printed for *John Martyn*, Printer to the *Royal Society*. 1671.

BRITISH MUSEUM
NATURAL HISTORY.

Trans. N°. 78

Tab. 1

I



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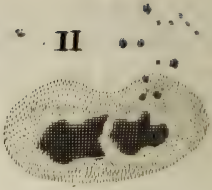

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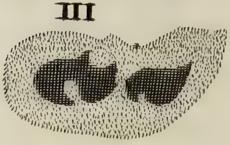

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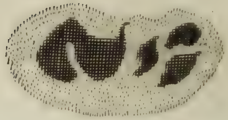

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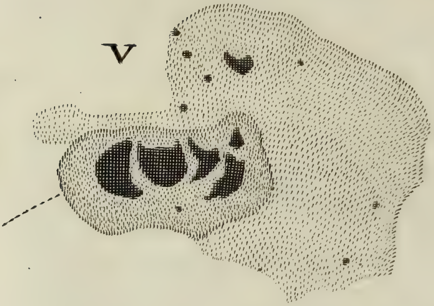

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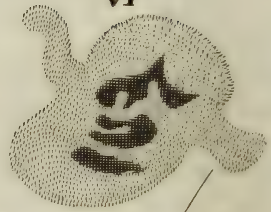

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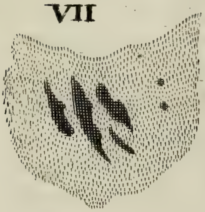

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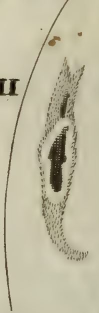


IX

Numb. 78.

PHILOSOPHICAL TRANSACTIONS.

Decemb. 18, 1671.

The CONTENTS.

Obſervations of the Spots *of the* Sun *continued; and ſome others concerning* Saturn, *and the preſent Diſ-appearance of his* Anſæ *or Arms; made at* Paris. *Extracts of ſeveral Letters; one, of Monſ.* Hugens, *concerning* Saturn: *Two others of Monſ.* Hevelius, *touching* Saturn *obſcured by the* Moon; *a* Lunar *Eclipſe; an Occultation of the firſt of the* Satellits *of* Jupiter *by the ſhadow of this Planet; a Tranſit of* Jupiter *and the* Moon; *and the late Appearance of* Saturn *to the ſame* Hevel. *Another Extract of a Letter from Doct.* Fogelius, *communicating the Obſervations, made at* Hamburg, *of the* returned *Spots of the Sun; together with a Note relating to the late Eclipſe of the Moon. Some Communications of Mr.* John Flamſtead *touching ſome late Appearances of* Saturn. *More Obſervations of Mr.* John Templer *about the Shining of* Glow-worms. *An Accompt of ſome Books:* **I.** *The ANATOMY of VEGETABLES, begun &c. by* Nehemiah Grew, *M, D.* II. *Diſſertations ſur la Nature du FROID & du CHAUD; avec un Diſcours ſur la Conſtruction & l'Uſage d'un CYLINDRE ARITHMETIQUE; par le Sieur* Petit, *&c.* III. *La DIOPTRIQUE OCULAIRE; par le P.* Cherubin *d'*Orleans.

The Obſervations of the SPOTS of the SUN, made at the Royal Academy at Paris, *Continued* *; *and Engliſh't out of French.*

* See the Beginning of them in *Numb.* 75.

HAving formerly communicated the Obſervations of the New *Spots* in the *Sun*, together with Signor *Caſſini's* way of noting their ſcituation in his diſque; which hath ſerved to determine the Time when they ſhould be viſible on its apparent ſurface, and how long they ſhould remain on his hidden Hemiſphere before their re-appearing to us, and laſtly to calculate the duration of their Periodical Revolution about his *Axis*; it may juſtly be exſpected, we ſhould give the Sequele of what hath been obſerved ſince the firſt and laſt appearance of theſe Spots.

It hath been noted in the *firſt* Paper, that in the laſt Obſervation, made the *thirteenth* of *Auguſt*, the Anterior Limb of the Miſty Crown encloſing all the Spots, was in the ſame Horary Circle with the Sun's center.

In the morning of the *fourteenth* of the ſame Month, from ſix to ſeven a clock, there paſſed 15″ of time between the paſſage of the Anterior limb of the ſaid Crown, and the paſſage of the Sun's center through the ſame Horary Circle: And then the Southern limb of the Crown was a *minute* and a *half* diſtant, toward the North, from the parallel of the *Equator*, paſſing through the ſame Center of the Sun. The *Figure* of the *firſt* Spot was almoſt the ſame with that of the day before. The *ſecond* had taken the form of an Heart, the point of which was turned to the North ſide, and its baſe between the South and the Eaſt. Three other ſmall ſpots, diſpoſed Triangle-wiſe, ſtood over the ſaid baſe, and were accompanied with two others upon a line turned South ward. And they were all encompaſſed by a Crown running out into a point on the South-ſide; and on the North-ſide, Eaſt-ward, it had an *Appendix*, as is repreſented in *Tab.* 1. *Fig.* 1.

The *fifteenth*, at ſix in the morning, there paſſed 27″ between the paſſage of the Anterior limb of the Crown, and that of the Sun's Center through the ſame Horary circle. The Southern limb of the ſame Crown was *two minutes* and *an half* diſtant from the parallel of the *Equator* paſſing through the center of the Sun, whoſe Diameter paſſed in 2′. 9″. through the ſame Horary circle. The firſt Spot had a little changed its figure; the ſecond was quadrangular, longer from Eaſt to Weſt, than from North to South; It appeared bigger than ordinary, and had withall on its ſides, within the compaſs of the Crown, three other ſmall ſpots. There were alſo ſeen four more without the ſaid Crown on the South ſide; as they are marked in *Tab.* 1. *Fig.* 2.

The *Sixteenth*, at ſix in the morning, there wete 27″ between the paſſage of the Suns Anterior limb, and the paſſage of the Anterior limb of the Crown through the ſame Horary circle; and 38″ between the paſſage of the anterior limb of the Crown, unto the paſſage of the Sun's center. The Southern Limb of the Crown was 3′½ off from the parallel of the *Equator*, paſſing through the Center of the Sun towards the North. And the Obſervation having been made yet more exactly at half an hour paſt ſeven of the ſame morning, this diſtance was found of 3′. 33″. The Figure of the firſt Spot in the beginning of the Obſervation differ'd not much from that of the precedent day; but afterwards it was ſeen divided into two. The ſecond, which likewiſe ſeemed to be the ſame in the beginning, was afterwards divided into three, accompanied with black and dark points without the Crown on the South-ſide, as may be ſeen in *Tab.* 1. *Fig.* 3 and 4.

The *ſame day*, at ſix a clock and 15′. at night, the figures of theſe Spots were much changed. They appeared of the ſhape, as we have endeavoured to repreſent them in *Tab.* 1. *Fig.* 5; where there are Five Spots encloſed in the Crown The two fore-moſt were part of that which had been ſeen in the morning as one; the two others following thoſe two firſt, were part of the ſecond in the morning; and without, there were five points on the South ſide; and two more, a little further to the North; which points were ranged as in another *area* made up of other points ſo ſmall, that they could ſcarce be perceived; and the Engraver hath been obliged (to make them perceivable) to repreſent them much greater than they were.

The *Seventeenth* in the morning, immediatly after the riſing of the Sun, there appeared three very dark Spots, which form'd in a manner theſe Letters, *F, n, J,* poſited from Eaſt to Weſt, and included in their wonted Crown, which ſtretched out, as 'twere, two Arms, or two Handles, one to the South, and the other to the North. There paſſed 18″. between the paſſage of the foremoſt limb of the Sun, and that of the foremoſt limb of the Crown, and 47″½ between the paſſage of the anterior limb of the Crown unto the paſſage of the Sun's Center. The Southern limb of the ſame Crown was diſtant 11′.17″ from the parallel that touched the Sun on the North-ſide, and 4′. 38″. from the parallel that paſſed through his Center. See *Tab.* 1. *Fig.* 6.

The *Eighteenth*, at ſeven in the morning, the Spots, which appeared through ſome clouds, had almoſt the ſame ſhape with thoſe of the day before, only with this difference, that they were a little cloſer together, drawing from Eaſt to Weſt. There is here no particular deſcription exhibited of them, for fear of failing in their exactneſs, by reaſon of the clouds which hindred to ſee them diſtinctly. There lapſed 13″. between the paſſage of the anterior limb of the Sun, and that of the anterior limb of the Spot, through the ſame Horary circle, and 52″½, of the foremoſt limb of the Spot unto the paſſage of the Center. The Southern limb of the Spot was 9′. 13″. diſtant from the parallel that touched the Northern limb of the Sun, and 6′.41″. from the parallel that paſſed through his Center. This Obſervation was ended between 7 and 8 in the morning.

At five a clock and 55′. at night of the ſame day, the Spots appeared as in *Tab.* 1. *Fig.* 7. There lapſed 11″. between the paſſage of the anterior limb of the Sun, through the ſame horary circle, and the paſſage of the anterior limb of the Crown, and from thence unto the paſſage of the Suns center, 54″½. The limb of the Crown next to the parallel paſſing through the center of the Sun, was diſtant from the ſame parallel, 7′.40″.

From four a clock to five in the evening of the *Nineteenth*, the Spot was obſerved whileſt the Sun was emerging out of Clouds. It appeared oblong near the Suns Circumference; from which it was diſtant about the breadth of the ſame Spot, as appears in *Tab.* 1. *Fig.* 8. And when we were preparing to meaſure its diſtance from the parallel of the Diurnal motion of the Suns Center, the Clouds, which roſe from the *Horizon*, intercepted it from our ſight.

The apparent velocity of the Spots, when they approached to the Suns center, (which had been noted in the *firſt* Diſcourſe) gave ground to determin their apparent Periodical Revolution about the Suns Axe about *Twenty ſeven days* and *an half*, ſuppoſing them to be adherent to his Surface, or at leaſt very nigh to it; and conſequently that from the morning of the 13th of *Auguſt*, when they were near his center, they ſhould take between ſix and ſeven days to arrive at the limb of his apparent diſque: the which hath come to paſs conformably to the Obſervations made ſince that time. For, ſince the morning of the 13th unto the evening of the 19th, when they were ſeen nigh the limb, there are 6½ days; and then they were yet ſo far diſtant from it, that it was eaſie to Judge, they would not come out that day. The Clouds and Night did then hinder to obſerve them; but in the morning of the 20*th*, which was not the full ſeventh from the day that they were arrived to the middle of the diſque, they were diſ-appeared. This likewiſe agrees well enough with what had been practiſed, *viz.* that theſe Spots during the fourth part of the time of their motion about the Suns center, calculated according to this *Hypotheſis*, and upon the firſt Obſervations, would remain in the *Weſtern* Quadrant.

The apparent Velocity nigh the Center was ſuch, that if it had continued the ſame, the Spots would have arrived almoſt in *four* days to the Limb of the diſque; but in this *Hypotheſis* this apparent velocity was to leſſen according as the Spots ſhould remove from the Center; as hath come to paſs in effect. The diminution of the Length of the Miſty Crown was in a manner proportionat to the diminution of the apparent Velocity; ſince that, when this Crown was in the midle, and in a ſcituation, wherein its true figure could be beſt ſeen, it appeared oblong, and of the form of an human Ear, its greateſt diameter reſpecting Eaſt and Weſt; but being nigh the Limb, this ſame diameter ſeemed to ſhorten; and having appeared greateſt in its firſt ſcituation, it appeared leaſt in this, becauſe it was almoſt in a circle that paſſed through the center of the Sun, whoſe equal arches are by ſo much the more oblique, by how much they approach more to the limb of his diſque, and conſequently appear leſs, according to the rules of Opticks; mean time the diameter,that was turned from South to North, apparently kept the ſame bigneſs it had near the center, becauſe it was in a circle almoſt parallel to the *horizon* of the Sun, which formed the repreſentation of its limb, and whoſe equal arches (by the ſame Optical reaſons) do not appear contracted.

Obſervations concerning Saturn, *made in the ſame place with the former.*

AT the ſame time that the *New Spots* of the Sun began to appear, Signor *Caſſini* obſerved in Saturn alſo ſomething remarkable, in regard of the un-expected Change of his Figure. Aſtronomers know, that this Planet is for the moſt part ſeen with Arms or *Anſes* faſtned to the two ſides of his diſque, when he is beheld with ſome great Teleſcope; and that he retaketh not his *Round Figure*, but every *fifteenth* year. This Change was to come to paſs this preſent year, and Saturn to appear in that Round Figure, without his *Anſes* or Handles, according to the *Hypotheſis* and Predictions of M. *Hugens*, publiſh't *A.* 1659; which indeed hath ſo hapned,but not juſt within the time he had appointed: For this Spherical figure of *Saturn* ſhould not have appeared, according to his ſuppoſitions, but in the month of *July* and *Auguſt*, and ſo continued for the reſt of the time that *Saturn* was to be viſible at this time, and even for a part of his appearance in the next year; but this Roundneſs hath been perceived ſooner, and Saturn hath appeared orbicular ſince the end of *May*, at a time when he was diſtant enough from the Sun and the Horizon, to be well obſerved. He hath remained in this *figure* unto the *Eleventh* of *Auguſt*. The ſaid Signor *Caſſini* did then obſerve him thus; but *three* days after he ſaw him *with Arms*, though very narrow ones,which do ſtill continue *. They are repreſented in *Tab.* 1. *Fig.* 9.

* See M. *Hugens's* Letter below.

Monſieur *Hugens* having examined theſe Appearances, and the Cauſe of the difference from what he predicted of them, finds not that they are contrary to his Hypotheſis of the *Flat* Ring about Saturn, by the means of which he explicateth all the Changes of his figure; but he eſteems, that they will ſerve to determine, more preciſely than could be done hitherto, the ſeveral Appearances of this *Round* figure; and becauſe he foreſeeth, that it will ſo appear again within a little time, and at the furtheſt in *December* next, and that the ſame will ſo continue the remaining time of its Appearance, he conſiders the Return of the Arms, which do at preſent appear, as a little interruption of this *Round* figure; which would not ſo much as have been perceived with midle-ſized Glaſſes of 6 or 7 feet, like thoſe that were uſed by *Galilæi* and *Gaſſendi*: which Experience may verifie, if inſtead of Teleſcopes of 15 or 20 feet long, you employ only ſome of theſe ſmaller ones, with which you are not able to diſcern theſe Arms becauſe of their tenuity, and that they are but faintly illuminated by the Sun-beams, which do more obliquely fall upon the *flat* ſurface of the Ring.

Monſieur *Hugens* believeth alſo, that *Saturn* will appear the next Summer, after his Conjunction with the Sun, with Arms like thoſe he hath now; in which he amends his Prediction of *A.* 1659; having ſeen by theſe laſt Obſervations (as he was already aware of it in his *Syſteme*,) that this Round appearance is to be defin'd to a leſs number of degrees than he had done, in reſpect of great Teleſcopes.

An Extract

An Extract of a Letter, written at Paris *Novemb. 7. 1671. (ſt. n.) by Monſieur Chriſtian* Hugens de Zulichem *to the Publiſher; concerning the Obſervations of* Saturn *mentioned in the next foregoing Diſcourſe: Engliſh't out of* French.

S I R,

THere is ſomething indeed, that hath kept me, week by week, from writing to you; which is the Printed paper, accompanying this Letter. For the Obſervations of *Saturn*, therein contained, I had deliver'd two Months ago; but Signor *Caſſini*, purpoſing to publiſh at the ſame time the ſequel of his Obſervations of the *Solar Spots*, the Engraving, and other circumſtances have cauſed ſuch a retardment, that all this appears not till now, and that to my great regret, becauſe having predicted the Return of the *Round* Figure of Saturn towards the End of this year, there wants but little but that the Prediction is accompliſh't before others have been advertiſed thereof. I ſay this as to Forraign Countries; for our Philoſophers here know very well, that as ſoon as Signor *Caſſini* had told me, that the *Arms* of *Saturn* were returned, I ſaid, that aſſuredly they would diſ-appear before the End of this Year. I ſtill obſerved them yeſterday in the evening, but they were ſo faint and obſcure, that it was hard to diſcern them; ſo that within a few days they will appear no more at all. This confirms altogether my *Hypotheſis* of the *Ring*, which now diſappears in proportion that the rays of the Sun do obliquely illuminate the *flat* ſurface of it, obverted to our ſight. And the Appearances of this year give occaſion to predict the Return of the *Round* figure with much more exactneſs, than before.

An Extract of two Letters of M. *Hevelius*, of *June* 19. and of *Octob.* 7. 1671; containing ſome of his late Celeſtial Obſervations, touching *Saturn* obſcur'd by the *Moon*; a *Lunar* Eclipſe; and an Occultation of the firſt of the *Satellits* of *Jupiter* by the Shadow of *this* Planet; a Tranſit of *Jupiter* and the *Moon*; and a late Appearance of *Saturn*: All here deliver'd in the Language, wherein the Author communicated it.

NUper, 1. Junii *ſt. n. rurſus* Saturnum *à* Luna *tectum mihi ex voto annotare obtigit: Initium Occultationis accidit horâ matutinâ hîc* Dantiſci 3.38′.27″. *circa* Montem Germanicianum. *Linea Itineraria, quantum ex ſolo ingreſſu haud obſcurè colligere licuit, tranſiit per M.* Ætnam; *centrum ferè Lunæ, per M.* Horminium, *M.* Herculis, *& ſuperiorem partem* Maris Caſpii. *Erat ſpectaculum multò jucundiſſimum, Sole oriente, Saturnum occultari, ac Tubo 20. ped. appulſum diſtinctè admodum animadvertere; facies tamen Saturni genuina, ejuſque annuli, eo Tubo, eóque tempore, haud ſatis accuratè, ob diluculum Solemque Horizonti adeò vicinum, apparuit: hinc etiam Saturni exitum, ut ut omnem admoverim lapidem, neutiquam deprehendere mihi licuit; præſertim cùm Sol ad duodecim propemodum gradus jam elevaretur. Nihilominus meritò nobis gratulamur, quòd hanc rariſſimam occultationem Saturni nobis obſervare obtigerit. Ego, quantum memini, bis tantum, ſi hujus anni obſervationem excipias, intra* 41. *annos, Saturnum à Luna tectum vidi; Anno nimirum* 1630. *die* 29. Junii, *veſp. hor.* 11. *cùm in freto Danico circa Inſulam* Huennam *verſarer: Rurſus Anno* 1661. *die* 3. Auguſti *hic* Dantiſci *hora* 7.58′.20″. *veſp. Nam etſi tales Occultationes ſæpius contingant, non tamen ſemper ſerenitas Cæli affulget, ut eas obſervare poſſimus, nec momentum Conjunctionis in noſtro ſemper accidit Horizonte.*

Eclipſis Lunæ Totalis A. 1671. Sept. 18. ſt. n. obſervata *Gedani* à *Joh. Hevelio*, ſolummodo ſub finem.

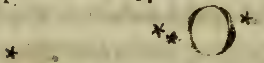
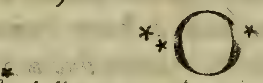
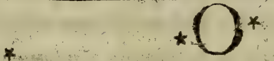
AD hanc obſervationem Eclipſeos Lunæ totalis *cum mora veſperi ingruentis ſummâ alacritate nos accinximus, præ primis cùm non ignorarem, Præcellentes viros, diverſis in locis, ſummâ diligentiâ pariter eam obſervaturos. Sed tota die ab ortu ad occaſum, imò ad horam 8. 30'. uſque, pluviæ affatim inceſſerunt, ut nihil quicquam de Lunæ exortu, occaſuque Solis, nec de initio Eclipſeos, totalique obſcuratione deprehenderimus, ut ut avidiſſimè ea omnia exſpectaſſemus. At hora 8. 30'. per nubes dehiſcentes, ſatis tamen craſſas, Lunam ſubobſcurè animadvertimus, & quidem tanto lumine jam imbutam, ut dixiſſes, Eclipſin jam eſſe præteritam. Quandoquidem ob illas denſiores nubes non dabatur, neque nudo oculo, neque armato bene longis & præſtantiſſimis Teleſcopiis,* 20. viz. *pedum, Lunam rectè diſcernere; An ſcil. Luna jam lumen ſuum omninò recuperaſſet, an vero tantùm particulâ aliquâ gauderet? nihilominus ſatis ſuperque exinde certum erat, totalem obſcurationem jam minimùm eſſe eo tempore præteritam, imò aliquanto adhuc citiùs: Siquidem Lunam rurſus adeſſe nos omnes per nubes illas ſatis dilucidè deprehendimus; qua de re eo tempore haud parùm mirabar; quippe ſciebam optimè, Calculum Rudolphinum Initium hujus Eclipſeos hîc* Gedani *indicaſſe Hor. 6. 17'. 19. totalem Immerſionem Hor. 7. 14'. 25"; maximam Obſcur Hor. 8. 10'. 26"; emerſionem Hor. 9. 6'. 27". & finem Hor. 10. 3'. 33". Ex eo vero phænomeno elucebat, hor. 8. 30'. jam Lunam minimùm aliquid luminis recuperaſſe; quod tamen calculo, ultra dimidiam horam, adverſabatur: Sic ut Eclipſis in Cœlo multò citius ingruerit, quàm* Kepleri *Calculus id indicaverit: De quo etiam brevi poſt adhuc certiores facti ſumus. Nam nubibus aliquanto diſſipatis, animadverti, Hor. 8. 34'. minimùm ad integrum digitum jam extra umbram ſeſe Lunam extricaſſe; & denuo hor. 9 41'. ad 1½ dig. lumen Lunæ jam excreviſſe, quantum id dijudicare circiter dabatur. Certò enim dictas phaſes definire, & ſecundùm Maculas delineare, neutiquam nubes obſcuriores pluviæque permiſerunt; quandoquidem nec meliori Tubo ne unicam quidem maculam diſcernere potuimus. Deinde ab hoc tempore obſcuriſſimæ nubes, pluviáque ſatis denſa rurſus totum Lunæ* *adſpectum nobis planè eripuerunt, ut nihil amplius de hac notabili Eclipſi (neque phaſes ullas, neque ipſum finem) annotare potuerimus, præter ea leviuſcula, quæ commemoravimus: Quæ tanti non ſunt, ut ad differentiam Meridianarum rectè cognoſcendam vel determinandam aliquid (uti quidem à nobis omnibus conſtitutum erat) contribuere poſſint. Interea tamen abunde ad id ſufficiunt ut oſtendant, Eclipſin hanc citius revera incidiſſe, quàm calculus* Rudolphinus *oſtenderit.*

Occultatio Primi Jovialium ab umbra Jovis.

C*UM Anno* 1671. *die* 25. Sept. *ſt. n. manè ex condicto Dn.* Caſſinus *Pariſiis, & Dn.* Picard *Uraniburgi ſuſcepiſſent, ad occultationem Primi* Jovialium *attendere, volui haud minus ego huic Phænomeno diligenter invigilare; ſed frequentiſſimæ nubes ab hora* 2. *ad h.* 4. 27'. *impedivêre, quò minùs* Jovem *vel ſemel quidem conſpexerim. At ubi emicuit, deprehendi, adhuc* 4 Joviales *omnes adeſſe, tres ſc. à lævâ, & unus ad dextram. Duo illi propinquiores ad ſiniſtram haud procul videbantur à limbo* Jovis, *non minus ille, qui ad dextram apparebat, aliorum Comitum minimus. Hærebam autem initio, quinam duorum illorum viciniorum occultari deberet, cùm ferè pari interſtitio à* Jove *removerentur, tum motu propemodum tardiori incederent. Hinc dubius ferè eram, an etiam eo ipſo tempore matutino, appropinquante jam aurorâ, umbram aliquis incurrere poſſet. Quippe ad quintam uſque &* 7'. *ferè, omnes quatuor (ut ut cælum jam liveſceret, atque* Joviales *ob leviuſculas nubeculas ægrè interdum ſpectarentur) diſtinctè apparebant. Præter tamen omnem ſpem, Hor.* 5. 12'. *videbatur mihi propinquior ille Comes ad lævam (reſpectu Tubi mei, qui inverſo ordine objecta exhibet) penitùs evaneſcere, remanentibus illis tribus, quanquam ille dexterior magis magiſque etiam ad* Jovem *accedebat. Ab eo tempore, quouſque ob cælum planè nubilum adſpectus Jovis mihi concedebatur, hor. ſcil.* 5. 23', *haud plures, quàm* 3 *deprehendi, in ſimili conſtitutione, ut ſub* N° 3 *vides. Illi comites ad Siniſtram abunde micabant, imprimis ille vicinior, qui ſocium amiſerat; alter vero ad dextram, vix ac ne vix conſpectus, ob auroram jam bene adultam. An planè momentum ipſum temporis id fuerit immerſionis illius Comitis, vix auſim adeò certò affirmare;*

firmare; nihilominus tardius non incidit illa occultatio; ſed anne unico minuto ferè, adhuc citius fortè, ingruerit, facile conceſſerim. Menſe Octobri & Novembri *cumprimis, quando* Jupiter *à Sole erit remotior, puto poſſe accuratius illa Phænomena animadverti.*

Vtrum autem æquè benè hæc Phænomena ad inveſtigandam differentiam Meridianorum *conducant, ut quidem Occultationes* Fixarum *à* Luna, *habeo fere cur dubitem; præprimis ob minus tardum* Jovialium *motum; quòd hiſce menſibus fere ſemper in aurora obſervari debeant, quæ magno eſt impedimento accuratis obſervationibus, ut ut etiam accuratiori Tubo, (quemadmodum & ego hac vice Teleſcopio* 20. *ped. uſus ſum,) peragantur.*

Sec.hor.amb. mane.	*A.* 1671. *Sept.* 25. *ſt. n.* *Immerſ. Primi Jovial in Vmbram* ♃.	*Diſtantiæ & Altitudines.*	*Quo inſtrumento.*	*Tempus correctum.*
Hor. ′ ″		° ′ ″		*H.* ′ ″
4. 36. 25.	*Jupiter primum conſpectus.*		*Tubo* 20 *ped.*	4.32. 0.
4. 42. 40.				4.38. 0.
4. 51. 5.				4.47. 0.
5. 7. 25.	*Altitudo Procyonis.*	34.43. 0.	*Quadr. Orich.*	5. 2. 7.
5. 11. 0.			*Tubo.*	5. 7. 5.
5. 16. 35.	*Primus Jovialium evanuit.*			5.12. 0.
5. 17. 5.			*Tubo.*	5.13. 0.
5. 21. 0.				5.18. 0.
5. 26. 5.	*Altitudo Procyonis.*	36.39. 0.	*Quadr. Orich.*	5.23.27.

Jovis & Lunæ Tranſitus, A. 1671. die 30. *Septemb.* ſt. n. mane obſervatus *Gedani* à *Joh. Hevelio.*

UT*ut Ephemeridum Scriptores ad diem* 30. Septemb. *Occultationem* Jovis *à* Luna *fore* Americanis *ſolis conſpicuam prædixerint; nihilominus tamen hîc* Gedani *ego invigilare huic Phænomeno volui, ratus, ſi Cælo ſereno & bene longis ac præſtantioribus Teleſcopiis uterer, fore, ut ea non minus à nobis* Europeis, (*ſi non noctu, ſaltem interdiu*) *quàm* Occidentalioribus, *dummodò vigilaremus, conſpiceretur, licèt orto jam Sole ipſa Conjunctio, horâ ſcil. 7. matutinâ, juxta Calculum* Rudolphinum *incidat. Proinde ſudo admodum Cælo,* Lunam *protinus orientem, nec non paulò poſt* Jovem, *Tubo* 20. *pedum ſummâ aviditate excepimus, atque deprehendimus Octante noſtro permagno Orichalcico, 9. ferè pedum radio,* Jovem *à* Lunæ *limbo Orientali adhuc* 1. *gr.* 23'. 40''. *eſſe remotum;* Jovialeſque *omnes quatuor à dextra, à qua Luna accedebat, adeſſe, eo propemodum ſitu, quem Delineatio oſtendit. Si aliquanto citius incidiſſet Conjunctio, atque calculus non aberraſſet, jucundiſſimum fuiſſet ſpectaculum, omnes* Joviales *ſucceſſivè unum poſt alterum à* Luna *abſorberi.* Vid. *Tab.* 2. *Fig.* 1. *Sed nulla fuit* Occultatio, *ut exitus docuit, ſed arctiſſimus tantùm accidit* Tranſitus, *Lunæ ſcil. falcatæ decreſcentis, tenuique admodum lumine ſplendentis. Cæterùm, quò accuratius hoc Phænomenon animadverterem, complures diſtantias,* Jovem *inter &* Lunæ *limbum Orientalem, lucidiorem nempe, ſum ſcrutatus, primùm permagno illo, quem dixi, Octante, quouſque Solis præſentia id concedebat; deinde Tubo, & conjecturâ, meliori quo licuit modo, ſum aſſecutus; ſicut & ipſâ Obſervatione vides. Initio quidem dixiſſes, fore* Jovem *reverâ tectum à parte* Lunæ *Auſtrali; ſed* V. *Fig. eandem.* *cùm ipſa* Jovem *proprius accederet, clarè admodum vidimus, Sole licèt jam orto,* Lunam *ſupra* Jovem *tantummodò tranſituram. Ipſum quidem Conjunctionis momentum inſperatus quidam Caſus infelicior deprehendere prohibuit. Cùm enim* Jupiter *ad limbum* Lunæ *orientalem ad* 3' *jam accederet, atque ad* 6' *duntaxat à linea Conjunctionis, per utrumque Cornu ducta, diſtaret, ecce ſupervenientes nubeculas, quæ tam* Jovem *quàm ipſam* Lunam, *nobis è conſpectu, magno noſtro dolore, eripuerunt; ſecus enim op-*

timè & perquam diſtinctè ipſum Conjunctionis punctum obſervaſſem: quandoquidem (quod ſane miraberis) & Lunæ *corniculatam faciem, utpote tertiâ tantum ante Solis conjunctionem die,* & Jovem, *Sole licèt ad* 8 *vel* 9 *grad. elevato, optimè & accuratè conſpeximus; quippe brevi pòſt, cùm cælum rurſum ſudum fieret, aliquoties, imò continuò quouſque libuit,* & Jovem & Lunam *ſumma cum jucunditate contemplati fuimus. Profectò phænomenon hoc, ut oppidò rarum, ſic fuit obſervatu digniſſimum; eoque magis, quo diurno tempore accidit: Qualium Obſervationum, utut ſint rariſſimæ, tres tamen ipſe, unius anni ſpatio, circe* Venerem *ſcilicet,* Saturnum *&* Jovem, *feliciter peregi. Animus quidem erat, circa hunc* Jovis *Tranſitum plures & majores diſtantias* Jovis *&* Lunæ *à Fixis quibuſdam, ob horum Planetarum loca eò accuratius obſervanda, ex ipſo Cælo depromere; at cùm ſtatim Aurora ingruerit, mihique ſoli, cum unico ſocio relicto, omnia peragere, tam Quadrante, Octante, quàm Tubo, incubuerit, in tanto temporis ſpatio, ut harum rerum gnari norunt, fieri illud haud licuit. Ex iis tamen, quæ obſervata fuere, abunde patet,* Tabulas *Aſtronomicas plus promittere, quàm revera adhuc præſtare, ideoque ſeria correctione, non ſecundum Longitudinem modò, ſed & Latitudinem, indigere; quandoquidem Tabulæ Rudolphinæ* Occultationem, *eamque multò citius, promiſere, cùm tamen nulla omninò fuerit, ſed, ut dictum, arctiſſimus ſolummodò ad duos propemodum digitos, tranſitus extiterit, horâ ſcil.* 7.26'.0".

Facies *Saturni* A. 1671. de 11 & 12. *Septemb.* ſt.n. in 17° ♓ obſervata *Gedani à Joh. Hevelio*

Vid. *Tab.* 2. *Fig.* 2

AER *turbidus obſtitit, quò minus poſt* 1 Junii *ad* 11 Septemb. *ne ſemel quidem* Saturnum, *Lunâ ſilente, notare ac delineare potuerim. Quali autem facie tunc temporis (nuper die* 11 *Sept.) apparuerit, quàm rectiſſimè & diligentiſſimè delineavi, atque hîc tranſmiſi. Oportet, ut vobis eodem tempore ſimili formâ* Saturnus *viſus fuerit. An verò menſe* Junio, Julio *&* Auguſto *eum planè rotundum conſpexeritis, ut volunt* Pariſienſes, *vix mihi imaginari poſſum. Etenim, utut brachia Saturni ad latera apparuerint arctiſſima, etiam Tubo* 60 *&* 70 *pedum; haud tamen credo, ea omninò evanuiſſe, ita ut ne veſtigium aliquod fuerit reliquum. Fortaſſè* Pariſienſes *Teleſcopiis brevioribus* *in ipſo crepuſculo, Lunâ præſente, Saturnum contemplati ſunt; quo tempore vix ac ne vix datur ſubtiliſſimum illud phænomenon (uti mihi, primo* Junii, *Tubo 20 pedum, Saturnus cùm occultaretur à Luna, obtigit,) ritè ac diſtinctè cognoſcere. Scripſi hac de re nuper ad Dn.* Caſſinum, *& Dn.* Picardum; *quid reſponſuri ſint, avidiſſimè exſpecto.*

An Extract of a Letter, written from *Hamburg Novemb.* 1. 1671. by the Learned Doctor *Fogelius* to the Publiſher, concerning the *Spots* of the *Sun* returned; and the laſt *Eclipſe* of the *Moon*; Here communicated alſo in the ſame language, in which it was written.

—*Maculæ Solares iterùm nobis apparuerunt, nunc tamen non amplius viſibiles. Mitto Cl.* Henrici Siferi *Obſervationes, Teleſcopio mediocris longitudinis hic factas. Poſtremis quidem Cælum feliciter favit, adeò ut à primo ferè die, quo iterum apparere cæperunt, ad uſque* 5 Septembris, *quo ad Limbum quàm proximè acceſsêre, continuo quaſi filo tum Motus tum Figura earum repræſentari potuerint.*

Æque nos hic, ac Hevelius Gedani, *calculum* Rudolphinum *in nupera Eclipſi, die* 8 Sept. *facta, aberraſſe deprehendimus. Emerſiſſe enim jam* Lunam *ex umbra* Terræ *ante horam nonam etiam hic vidimus. Juxta Calculum modò dictum,* Gedani *emerſiſſe debuerat h.* 9. 6'. 27". *Tempus autem utrobique nubilum Obſervationes utrobique invidit.*

Maculæ in Sole obſervatæ Hamburgi A. 1671.

*iebus men-*ſ Auguſti.	*Et* Sept.
26—*h.* 8.*matut.*	1—*h.* 1.*pomerid.*
27—*h.* 1.*pomerid.*	2—*h.* 2.*pomer.*
28—*h.* 1.*pom.*	3—*h.* 11.*antemer.*
29—*h.* 11.*antemer.*	4—*h.* 12.*merid.*
30—*h.* 11.*antem.*	5—*h.* 11.*antem.*
31—*h.* 1.*pomer.*	*Et h.* 4.*pomeridianâ*

V. *Tab.* 2. *Fig.* 3.

non amplius viſa eſt mihi H.S.

Extracts

Extracts of two Letters written from Darby, *Novemb.* 21. *and Decemb.* 2. 1671. *by Mr.* John Flamſtead *to the Publiſher, touching ſome late Appearances of* Saturn.

The *firſt* ſpeaks thus;

—OCtob. 12. laſt paſt, at my firſt viewing *Saturn* with my leſs Tube, I thought I ſaw ſomething on each ſide of him, amidſt the Colours of my Glaſs and the Spurious rays of his Body. Directing my longer Tube (of 14 feet) to him, I could ſee his *Anſes* ſomewhat more diſtinctly, but very ſlender, and to one, that thought not of them, ſcarce diſcernable.

The *other* ſaith;

Laſt Thurſday night, *Novemb.* 30. (the only clear night we have had of late,) I obſerved *Saturn* with my 14 foot Teleſcope, the Aperture being 1½ inch, and its Eye-glaſs drawing two inches. He appeared perfectly round, free from rays and colours, and no *Anſæ* to be ſeen. My worthy friend Mr. *Townly* in his laſt to me, bearing date *Novemb.* 20. 1671., deſireth me to continue the Obſervations of *Saturn*, telling me, that he looked at him one night, and could hardly diſtinguiſh his Line of the *Anſulæ*, but plainly ſaw a dark line through him near his Upper part.

A week or two after the Obſervation of Saturn, which I made Octob. 12. and ſent you in my former, I had frequently the ſame Appearance, though in a wider Aperture, than I uſe at preſent, &c.

Some further Obſervations of Mr. John Templer, *about the ſhining of Glow-worms* [*].

I Have now ſent you what my Journal will further afford upon that ſubject, I wrote to you formerly of.

June 1. 71. Upon ſeveral tryalls of different poſitions, I find the Glow-worm not to ſhine ſometimes when in motion, but I could never yet ſee her ſhine, when not in motion of ſome part.

June 8. 1671. after ſome days abſence from home, putting the Glow-worm into an Urinal of white Glaſs at 9 a clock at night, ſhe crawled nimbly in it, and extended her ſelf beyond an ordinary length; yet her ſhining not ſo clear, as in her box when opened: Putting the urinal into the water for about ½ an hour, it gave a very delightful irradiation of the water. When this light ſeemed wholly extinct, although ſhe was in motion, if I depreſſed the urinal into the water, till the bottom almoſt touched the bottom of the baſon, I could (upon looking in at the top of the urinal) ſee a very fair light, but upon lifting the glaſs out of the water, I could diſcern very little ſhining; Then putting her into her box, ſhe did in about a minutes time (for I tryed it twice over by a watch,) almoſt ten times increaſe her former ſhining in the urinal.

June 14. 71. After a ſecond abſence, the worm ſeemed dead, and being ſhut in a box, would give no light through it betwixt 9 and 12 a clock at night; but in the uncovered box, or in the urinal ſhe did ſhine faintly, and the light was of a far different colour from what it was formerly.

June 15. 71. She ſeemed dead. I touched her with a needle gently, whereupon ſhe ſtretched out one of her legs, and by it (when I inclined the poſition of the box) ſhe ſtayed her whole body from falling; whereas before ſhe rowled from one ſide of the box to the other, as I inclined or reclined it. Note, that before I pricked her, ſhe did give a little ſhining in her uncovered box, but none through the urinal; only if you looked in at top, a little ſhining was ſeen. Upon pricking her I did not ſee her ſhining encreaſed.

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[*] See *Numb*. 72. of theſe Tracts.

June 16. 71. I diſcerned a little ſhining only within her box; upon pricking I could diſcern no motion in her; but the ſcale next her tayl was ſenſibly *more* extended a $\frac{1}{4}$ of an hour after I pricked her, than before. NB. Theſe laſt three days, ſhe lay continually upon her back with her legs contracted, except only the time mentioned *June* 15 of my pricking her. I am afraid to conclude her dead. *June* 16, having been informed by M. *Th. Hallebeck* of *Cald Newton* near *Meltan Mawbury*, that he kept a glow-worm near 6 months in his parlour window, which would ſometimes ſeem dead for many *days* together (if I miſtake not, he ſaid *weeks*) and afterwards walk and ſhine both. However I ſhould be infinitely obliged to any one for favouring me with the characteriſtick note of a Glow-worm's being dead 24 hours *before* her ſhining ceaſed, that I might know when to conclude one dead in good earneſt; for I am promiſed in a little time ſome ſtock of theſe Inſects, which, I hope, may give the advantage of further and more ſteady obſervations.

An Accompt

An Accompt of ſome Books.

I. *The* ANATOMY *of* VEGETABLES *begun; with a General accompt of* VEGETATION, *founded thereon: by* Nehemiah Grew *M.D. Fellow of the* Royal Society, 1671. *in* 12°.

THe Ingenious and Learned Author of this Book conſidering with himſelf, that the *Anatomy* of *Vegetables* hath hitherto been much uncultivated, and that yet it very well deſerved the labours of diligent Naturaliſts, hath here attempted to make a very particular Inquiry into the Conſtitution and Structure of Plants, and thereupon to found a rational Diſcourſe concerning the Nature of Vegetation. Which being undertaken by him, he advertiſeth thoſe that ſhall think fit to examine theſe Obſervations of his, not only, that they begin, and ſo proceed till they end again, with the *Seed*; but alſo, that they confine not their Inquiries to one time of the Year, but to make them in ſeveral Seaſons, wherein the Parts of a *Vegetable* may be ſeen in their ſeveral Eſtates: And then, that they neglect not the *Comparative* Anatomy, confronting ſeveral Vegetables and their ſeveral parts together.

The Method he chuſeth in the proſecution of this ſubject, is the Method of Nature her ſelf, in her continued *Series* of Vegetations, proceeding from the *Seed* ſown, to the formation of the *Root, Trunk, Branch, Leaf, Flower, Fruit*; and laſtly, of the *Seed to be ſown again*, or in its ſtate of Generation.

Diſcourſing of the *Seed* as Vegetating, he diſſects a *Garden-Bean*, and ſhews the two *Coats* thereof; the *Foramen* in the outer *Coat*; and what is generally obſervable of the *Covers* of the Seed. This done, he diſplays the proper Seed it ſelf, and therein finds three conſtituent and as 'twere Organical parts of the Bean, *viz.* the Main Body, always divided into two Lobes (though in ſome few other ſeeds into more;) and two other appendant to the *baſis* of the Bean; whereof the *one* is called by him the *Radicle*, being that, which, upon the vegetation of the Seed, becomes the *Root*; the *other*, the *Plume*, which becoms the *Trunk* of the Plant; and being divided at its looſe end into divers pieces, (all very cloſe ſet together as *Feathers* in a bunch) theſe pieces are ſo many true and already form'd, though not diſplayed, *Leaves*, intended for the ſaid Trunk, and foulded up in the ſame plicature, wherein, upon the Bean's ſprouting, they do appear. Theſe Organical parts he finds compoſed of theſe Similar ones, *viz.* 1. the *Cuticle*, extending it ſelf over the whole Bean, and herein diſtinguiſht from the *Coats*, that whereas *theſe*, upon ſetting the Bean, do only adminiſter the ſap, and then die; the *Cuticle* is with the Organical parts of the Bean nouriſh't, augmented, and coextended. 2. The *Parenchyma* it ſelf, having ſome ſimilitude to the pith, while ſappy, in the roots and trunks of plants; common *to*, and the ſame *in*, the Lobes, Radicle and Plume of the Bean. 3. The *Inner Body*, diſtributed throughout the *parenchyma*, but withall eſſentially different from it; called by the Author the *Seminal Root*, and diſtinguiſh't from the *Radicle*, in that the former is the Original root within its ſeed, the latter is the Plant-root, which the *Radicle* becoms in its growth; the *parenchyma* of the ſeed being, in ſome reſemblance, that to the *Seminal root* at firſt, which the *mould* is to the *Plant-root* afterwards; and the *Seminal root* being that to the *Plant-root*, which the *Plant-root* is to the Trunk. Having viewed theſe parts, he inquireth into their *Uſe*, and in what manner they are the Fountain of Vegetation, and concurrent to the Being of the future Plant.

Proceeding to the *Root*, (which he finds ſubſtantially one with the *Radicle*, as are the Parts of an Old man with thoſe of a *Fœtus*,) he therein obſerveth its *Skin*, *Cortical Body*, and *Lignous part*, together with the Original of each of theſe, and the *Pores* of the two latter, and their proportions; as alſo the *Pith*, and its Original, ſometimes from the *Seed*, ſometimes from the *Cortical Body*, together with its *Pores*, and Proportions: Moreover, the *Fibres* of the *Lignous* body diſperſed through the pith, and the *Cavity* and *Pith* of thoſe Fibres. Where he explains, How the Root grows, and what is the Uſe of its parts; how it grows in length and breadth; and how it deſcends; adding the Uſe of the *Pith*, *viz.* for the better advancement of the *Sap*, and its quicker and higher Fermentation, begun in the

Cortical Body, inſerted through the *Lignous part*, by which Inſertions the Sap, like the Bloud of the diſſeminations of the *Arteries*, is conveyed to its intimate parts: Our Author conjecturing, that the deſign, whereto all theſe parts are together concurrent, is the *Circulation* of the Sap.

Having thus declared the degrees of *Vegetation* in the *Root*, he next ſhews the Continuance thereof in the *Trunk*; the obſervables and parts of which are, 1. The *Skin*, derived from the *Cuticle* of the Seed: 2. The *Cortical Body*, originated from the *parenchyma* of the Seed: 3. The Lignous Body, being the Prolongation of the *Inner Body*, diſtributed in the *Lobes* and *Plume* of the Seed: 4. The *Inſertment* and *Pith*, proceeding alſo from the *Plume*, as the ſame in the *Root* from the *Radicle*; ſo that, as to their Subſtantial parts, the *Lobes* of the Seed, the *Radicle* and *Plume*, the *Root* and *Trunk*, are all one. Here notice is taken of the Shooting of the *Lignous body* in breadth; wherein are obſervable its *Fibres*, Production of *Rings*, and eſpecially *Pores*, and *theſe* of three ſorts, greater, leſſer, and leaſt of all; all continuous and prolonged by the length of the Trunk: which he proveth by an Experiment made by Mr. *Hook*, by filling up (ſuppoſe in a piece of *Char-coal*) all the ſaid Pores with *Mercury* which appears to paſs quite through them, as is viſible by a good Glaſs. The reſult of all is, that the *Woody* part of a Vegetable is nothing elſe but a Cluſter of Innumerable and extraordinary ſmall Veſſels or concave Fibres. He farther ſhews the *Inſertions* of the *Cortical body* in the *Trunk*, and the *Pores* of thoſe Inſertions; in none of which *pores* he could obſerve any thing, that may have the true nature and uſe of *Valves*; the non-exiſtence of which he is aſſerting. He diſcourſes alſo of the *Poſition* and Tract of the Pores: and concludeth this Chapter by declaring, How the *Trunk* aſcends; How its parts, in conſequence of that Aſcent are diſpoſed; How that diſpoſition is conſequent to the different nature and energy of the *Sap*; what the effects are of that difference; which way, and how the *Sap* aſcends, *viz.* by the joynt ſubſerviency of the *Lignous* and the *Cortical Body* in ſome, but in moſt, and principally, of the *Lignous Body*, and *Pith*; the latter being here conſider'd as a Curious *Filtre* of Nature's own contrivance: where he examins, *How* the *Pores* of the Pith are permeable; and renders a reaſon, why a piece of *dry Elder-pith*, ſet in ſome tinged liquor, the liquor doth not then penetrate the Pores, ſo as to aſcend through the Body of the *Pith?* To this part is annexed, by way of *Appendix*, ſome Conſiderations of the *Trunk-Roots* and *Claſpers*, and the Uſe of both.

After this, he proceeds to the *Germen*, *Branch*, and *Leaf*, and finds in the two former the ſame parts with thoſe of the Trunk, *viz.* the ſame Skin, and the ſame *Cortical* and *Ligneus* Bodies, as alſo the ſame *Inſertment* and *Pith*, here-into propagated, and diſtinctly obſervable in it. Further, he ſhews the manner of their growth, and nutrition, and how the *Germen* is ſecured; as alſo the Uſe of the *knots*. Then he lays open the parts of a *Leaf*; and explains the Poſitions of the Fibres in the Stalks of Leaves, and the Cauſe of their different ſhape, and of their being flat. Then he diſcourſes of the *Foulds* of Leaves, their kinds and Uſe, together with the Uſes of the *Leaf* it ſelf. To this Chapter alſo he makes an *Appendix* of *Thorns*, *Hairs*, and *Globulets*, explaining both their Conſtitution and Uſe.

Next, he gives an Accompt of the *Flower*, and its three general parts, the *Empalement*, the *Foliation*, and the *Attire*; explaining the formation, nature, and uſes of all three, but moſt particularly of the *Attire*, which he finds to be of two kinds, *Seminy* and *Flory*; the *Seminy*, made up of two parts, *Chives* and *Semets*, the latter of which are hollow, yet not ſo but that they are filled up with minute particles, like a powder. The *Florid* Attire is commonly called *Thrumbs*, which are ſeveral *Suits*, of which this *Attire* is made up: The *outer part* of every *ſuit*, is its *Floret*, which is the Epitome of a *Flower*, and, in many Plants, all the Flower. The *next* part is from within its *Tube* brought to ſight, and is called the *Sheath*, likewiſe concave. The third part and the innermoſt of the *Suit* is the *Blade*, which is ſolid, yet at its point evermore divided into two halves; upon which diviſion there appears a *Powder* of *Globulets*, of the ſame nature with thoſe of a *Semet*. The Uſe of the *Attire* he aſſigns to be not only Ornament and Diſtinction to us, but alſo *Food* to a vaſt number of little Animals, who have their peculiar proviſions ſtored up in theſe *Attires* of Flowers; each Flower becoming their Lodging and their Dining-room, both in one: Though it cannot as yet be determined, Wherein the particular parts of the *Attire* may be more diſtinctly ſerviceable, this to one Animal, that to another; or to the ſame Animal, as a *Bee*, whether this for the *Honey*, another for their *Bread*, a third for the *Wax*; or whether all do only ſuck from hence ſome *Juice*, or ſome may not alſo carry ſome of the parts, as the *globulet*, wholly away, &c.

In the following *Chapter* he treats of the *Fruit*, conſidering the Number, Conſtitution, and Original of the Parts of an *Apple*, *Bean*, *Plum*, *Nut*, and *Berry*; and obſerving, that the general Compoſition of all Fruits is one; that is; their *Eſſential* and *Vital* parts, are in all the ſame, and but the Continuation of thoſe, which in the other parts of a Vegetable he hath already taken notice of. To which he ſubjoyns the *Uſes* of Fruits, both for *Man* and *Beaſt*, as alſo for the *Seed*; to which latter it ſerveth for ſupply of Sap, and for Protection and Security, the whole Fruit being, by comprehenſion, that to the *Seed*, what the Hen, by Incubation, is to the Egg or Chick.

In the *Laſt* Chapter he conſiders the *Seed* again, but in its ſtate of *Generation*; as he before examined it in its ſtate apt for *Vegetation*: where occurs, what in the other ſtate was either not diſtinctly exiſtent, or not ſo apparent, or not ſo intelligible. As firſt the *Caſe* of the Seed, and its *outer* Coat, their figures, various ſurface and Mucilages; together with the nature of the *outer* coat and its original: Then, the original and nature of the *inner* coat, in which the *Lignous Body* or *Seed branch* is diſcribed. Whereupon he obſerveth, that all the *Parts* of a Vegetable, the *Root*, *Trunk*, *Branch*, *Leaf*, *Flower*, *Fruit*, and *Seed*, are ſtill made up of two ſubſtantially different Bodies; and that, as every *part* hath two, ſo the *whole* Vegetable, taken together, is a Compound of two only, and no more; all properly *Woody* parts, *Strings* and *Fibres*, being one *Body*; all ſimple *Barks*, *Piths*, *Parenchyma's* and *Pulps*, and, for ſubſtance, *Pills* and *Skins* alſo, all but one Body: The ſeveral parts of a Vegetable differing from each other only by the various proportions and mixtures, and variouſly ſized pores of theſe two Bodies.

But to return, beſides theſe three Covers, he finds a fourth, which is the innermoſt, called by him the *Secondine*, the concave of which membrane is filled with a tranſparent liquor, out of which the *Seed* is formed. Through this membrane, the *Lignous Body* or *Seed-branches*, diſtributed in the *inner* Coat, at laſt ſhoot down-right two ſlender Fibres, like two Navils, one into each Lobe of the Bean: Theſe Fibres, from the ſuperficies of each Lobe, deſcend a little way directly down; and then preſently each is divided into two Branches, one diſtributed into the *Lobes*, the other into the *Radicle* and *Plume*.

As for the *Generation* of the *Seed*, dependent upon the Hiſtory delivered, he ſaith, that the *Sap*, having in the *Root*, *Trunk*, and *Leaves*, paſſed divers Concoctions and Separations, in the manner by him deſcribed, 'tis at laſt, in ſome good maturity, advanced towards the *Seed*. The more Copious and *Cruder* part hereof is again ſeparated by a free reception into the *Fruit*, or other part analogous to it. The more *Eſſential* part is entertained in the *Seed branches*, which being conſiderably long and very fine, the ſap becoms therein, as in the *Spermatick veſſels*, ſtill more mature. From hence it is next deliver'd up into the *Coats* of the Seed, as into a *Womb*, and the *meaner* part hereof is again diſcharged to the *outer* Coat, as aliment good enough; the *finer*, is tranſmitted to the *inner*, which being a *Parenchymous* and more ſpatious body, the *Sap* therefore is not *herein* a meer aliment, but in order to its being farther prepared by Fermentation. The *Sap* being thus prepared in the *inner* coat, as a liquor now apt to be the matter of the future *Seed-Embryo*, by freſh ſupplies is thence diſcharged, or filtred, or tranſpired through the *Secondine* abovementioned; and the depoſiture thereof, anſwerable to the *Colliquamentum* in an Egg, or to the *Semen muliebre*, is at laſt made into the Concave of the ſame. The other part of the *pureſt ſap*, imboſom'd in the *ramulets* of the *Seed branch*, runs a Circle, and ſo becoms, as the *Semen maſculinum*, yet more elaborate. With this pureſt Sap the ſaid *ramulets* being ſupplied, from thence at laſt the *Navel-fibres* ſhoot (as the Artery into the *Colliquamentum*) through the *Secondine* into the aforeſaid liquor, depoſited therein. Into which liquor being now ſhot, and its own proper Sap or tinctures mixt therewith, it ſtrikes it thus into a *Coagulum*, or into a Body conſiſtent and truly *parenchymous*. And in the interim of the *Coagulation*, a gentle *fermentation* being alſo made, the ſaid *Parenchyma* or *Coagulum* becoms ſuch, not of any Conſtitution indifferently, but is raiſed (as we ſee Bread in baking) into a *Congeries* of *fixed Bubles*; the *parenchyma* of the whole Seed being ſuch.

The whole is illuſtrated by ſeveral *Figures*, and theſe explicated with great care.

II. *Diſſertations ſur la Nature du FROID & du CHAUD; par le Sieur* Petit, *Conſeiller du Roy, Intendant des Fortifications, &c. Avec un Diſcours ſur la Conſtruction & l'Uſage d'un* Cylindre Arithmetique, *inventé par le meſme Autheur. A.* Paris, 1671.

THe famous Author of theſe two Tracts, examins in the former, *Firſt*, the Nature, Subject, Cauſe, and Effects of Cold. As to its *Nature*, he eſteems it to be a *Poſitive* thing, and not a meer *Privation*, the Effects of *it* being as ſenſible to us, as thoſe of *Heat*. For the *Subject* of it, he placeth the Supreme Cold in the Pure *Air*, and maketh the Heat, that is ſometimes in the Air, meerly adventitious; produced in it by the Sun, but the Cold natural to the ſame. Concerning the *Cauſe* of this Cold in the Air, he will not acknowledge it to be *Nitre*, (all ſorts of Salt being by him eſteem'd hot) much leſs an Univerſal Spirit, or any Stars; but eſteems, that the Air is the *Primum Frigidum* by nature; the ſame Cauſe, that hath made it Air, having made it Cold. The *Effects* of Cold being too obvious to diſcourſe of them in print, he enlarges upon the *Manner* of its operation, performed by the inſinuation of the Air into the pores

of

of Bodies, and increaſed by the force of Northerly winds; where he notes, that the Cold Air, by its parts, figur'd for the purpoſe, and penetrating ſuch bodies as are diſpoſed to glaciation, divides the parts of the ſame, and arreſts their motion. Here he endeavours to prove, that Frozen water is not properly condenſed, though it be hardned and fixed; but that 'tis rather dilated by the ingreſs of the Cold Air; whence he obſerveth that Ice is really lighter than Water.

Secondly, he diſcourſeth of *Fire*, after he hath diſcarded it from being one of the common Four Elements, and diſlodged it from its reputed place above the Air under the Concave of the Moon: And affirms, that 'tis the Heat of the Sun, which moves, quickens, and coagulates the three families of Mixts, Animals, Vegetables and Minerals, yet withall taking in a Subterraneous heat for the production of Minerals.

In the *Latter* Tract of this Book, the Author explains an Invention of his, of an *Arithmetical Cylinder*. For, finding that in the *Rabdology* of the Noble *Nepper*, the multitude and embaraſment of thoſe ſticks, filled with numbers on all ſides, proved longſom and tedious, and that thereupon the practiſe of the Invention had ceaſed; he conſider'd of a way to render it more expedit and eaſie, and at length concluded, to take bands of paſt-board inſtead of ſticks; on which having written the ſelf-ſame *Multiples* from 1 to 9, and made the ſame diſtribution of the numbers into little ſquares, ſeparated by a diagonal, drawn from the left to the right hand upwards, (as thoſe Sticks are;) he added thereto a *file* of *Roman* Numbers, I, II, III, IV, V, VI, VII, VIII, IX, to be put on the ſide, and over againſt the Multiplying and Dividing Numbers; very uſeful as well for marking the beginning and end of the ſaid numbers, to ſtop where 'tis needful (all the bands not being uſed in all operations,) as for marking the *Multiple*, which you ſhall uſe in each number. As, (*e.g.*) to multiply 7 by 5 or by 9, inſtead of being at the trouble of counting the ranks of theſe *Multiples* 5 and 9, they may be preſently ſeen in one or other of the *Files* of thoſe Roman Numbers. Having then employed theſe bands in raiſing or abaſing them on a table, to make thoſe principal numbers, that are neceſſary, to appear over againſt one another, he further bethought himſelf (for a yet ſhorter way,) to diſpoſe thoſe pieces into circles very equal, and to glew, upon each of them, 3 or 4 ſmall buttons of wood, of the bigneſs of a pins-head, and then to put them upon a *Cylinder* of wood or paſt-board, on which they might be turned by means of thoſe buttons: Which form made him call this little Inſtrument an *Arithmetical Cylinder*, which is of the bigneſs or diameter of a Childrens-Drum, or of the form of an Hat, and of what height you will, to hold as many bands or circles as you ſhall deſire to make great Operations.

The practiſe of this Inſtrument is ſhewed by divers Examples, as may be ſeen in the Book it ſelf.

III. *La DIOPTRIQUE OCULAIRE, par le Pere* Cherubin *d'* Orleans, *Capucin. A* Paris, 1671. *in Fol.*

THe Author of this large and elegant Volume, having propoſed to himſelf to comprehend in it and to teach all that concerns the Theory, Uſe, and Mechaniſm of the Teleſcope (by him called the *Ocular Dioptrique,)* divides it into three principal Parts.

The *Firſt* contains the Doctrine of Opticks and Dioptricks, or, of Simple viſion Direct, and that which is made by rays Refracted; both by him pretended to be handled with a ſuccinct, but ſingular, Method.

Diſcourſing of *Refraction,* he declares, That the Refraction of a viſual ray in Glaſſe to 30 degrees of inclination, is proportional to the Inclination of the ray, as far as ſenſe is able to judge of it. And that, the Inclination not exceeding 30 degrees, the Angle of the refraction of the ray, which

enters

enters into Glaſs, is about a third part of the Angle of the Inclination of the ray paſſing into the Air: But that the ſame Inclination not exceeding 30 degrees, the Angle of the refraction of the ray iſſuing out of the Glaſs into the Air, is about the half of the Angle of its Inclination in the Glaſs.

Examining, what the Diſſection of an Eye may conduce to the knowledge of the Refractions of its Humors, he noteth, That the Extinction of the vital ſpirits in a dead Animal doth extreamly alter the conſiſtence of the Humors of his Eye, which contributed much to the perfect viſion in the living animal: And that all the Experiments, that can be made by diſſecting of Eyes, to come to the knowledge of the Refractions of the Humors, and of the other parts that conduced to Viſion, cannot give the true knowledge thereof; Experience proving, that the Chriſtallin and Vitreous humors do reciproqually change their conſiſtence.

He obſerveth alſo, that not only the different Diaphaneities of the Humors of the Eye do contribute to the refraction of the viſual rays paſſing thorow them; but alſo the Figures of their Surfaces, on which thoſe rays fall unequally inclin'd. He noteth likewiſe, that the viſual rays, having penetrated the Corneous tunique and the Aqueous humor of the Eye, do not ſuffer any great refractions upon the *Anterior* ſurface of the Chryſtallin, though it be finer than the Aqueous humor; becauſe that its Spherical convexity is con-centrique to that of the *Cornea* and of the *Aqueous humor*, which are likewiſe ſpherical: But that they receive their greateſt refractions, when they paſs through the *Poſterior* ſurface of the Chryſtallin, which is oppoſite to them, and of a very ſmall Sphere, and upon which they are found much inclined.

He taketh further notice, That the ſurfaces of the Chryſtallin humor are not Hyperbolical but perfectly Spherical; and that the exactneſs, which by that means is pretended for Viſion, is contrary to Experience, by which he aſſerts it to be undeniable, that, though by Glaſſes of an hyperbolical figure,the rays, coming from the principal point of the object to the Eye, would more exactly meet in *one* point at the bottom of the *Retina*, and conſequently, that from one certain point of a determinate diſtance you would more perfectly ſee that point ; yet would not ſuch a figure reunite the rays of the other lateral points of the object, each exactly in a point of concourſe in the ſaid *retina*. So that, if the viſible object were nothing but a point, and the ſurfaces of the Chryſtallin hyperbolical, (which they are not,) there would then be made a more exquiſite viſion of that *only* point.

The *Second* part delivers the *Theory* of the Teleſcope in all its kinds : which is uſher'd in by a Hiſtory of the Invention and Antiquity of Teleſcopes ; and by a Diſcourſe concerning the Difference of the Ancient Glaſſes from the Modern.

This done, he explains the matter of this ſecond Part in XI. Sections.

1. Shews the power, which diaphanous *medium's*, leſs ſubtile then Air, and of figures ſimply Spherical, have in refracting the viſual rays paſſing thorow them.

2. Declares the Effects of Spherical Convex Glaſſes, to ſerve for the conſtruction of the Teleſcope of the *firſt kind*, which always ſuppoſeth the Eye between the Glaſs, and its point of Concourſe.

3. Conſiders the Affections of Spherical Concaves,to ſerve for the conſtruction of the ſame kind of Teleſcope.

4. Demonſtrates the Effects of the Conjunction of Spherical Convexes and Concaves,in the Conſtruction of the ſame ſort of Teleſcope.

5. Examins the Affections of Spherical Convexes , in the Conſtruction of a Teleſcope of the *ſecond* kind ; wherein the Eye is always more diſtant from the Convex Objective Glaſs, than its point of Concourſe , and which admits no Concave.

6. Shews the Effects of the Compoſition or Multiplication of Spherical Convexes,in the conſtruction of all ſorts of Teleſcopes of the *ſecond* ſort.

7. Demonſtrates, that the long Teleſcopes, which ſerve to ſee remote objects, may alſo ſerve to ſee near objects that are ſmall.

8. Demonſtrates the Conſtruction of Microſcopes, to ſee the ſmalleſt Objects.

9. Shews the Conſtruction of a kind of Mixt or Catadioptrique Teleſcope, compoſed of Refraction and Reflection.

10. Shews, that one may ſee at one and the ſame time, with both Eyes, one and the ſame Object, by a Teleſcope; and how to make ſuch an one.

11. Treateth of the Proportion of the reſpective Convexities and Concavities of Glaſſes, to ſerve for the conſtruction of a Teleſcope.

The *Third* part of this Volume is ſubdivided into two, which the Author calls the *Poſitive*, and *Mechanical*. The *Poſitive* teacheth the actual Conſtruction of Teleſcopes, and their Uſes, and that in 12 Sections.

1. Delivers the manner of proportioning poſitively the Power of Glaſſes for Teleſcopes; together with the choice of their figure, though ſpherical, and the tryal and graduation of their goodneſs.

2. Teaches how to work actually all ſorts of Teleſcopes, and how to uſe them.

3. Teaches the manner, actually to put into uſe the Catadioptrique Teleſcope, which redreſs the object by Reflection, that before had been inverted by Refraction.

4. Shews the way of making a double Teleſcope in all its kinds, to make Objects to be ſeen by both Eyes at the ſame time, much greater and much clearer, than with one Eye alone.

5. Teaches in general, how to make actually all ſorts of Microſcopes, to ſee diſtinctly and to magnifie very conſiderably the ſmalleſt objects.

6. Treats of the Uſe of the Teleſcope generally in all its kinds.

7. Teaches a New and peculiar uſe of Teleſcopes, for

drawing to the life in proportion, from a great to a ſmall volume, any Terreſtrial objects, that are at a competent diſtance to be well ſeen; without a neceſſity of having any skill in drawing.

8. Contains the Uſe of the Microſcope in all its kinds; together with a way of meaſuring, how much a Microſcope magnifies the Object.

9. 10. 11. Treat of the Uſe of Teleſcopes in the Obſervations of *Celeſtial* Objects: Where the Author enumerates the many excellent Diſcoveries, that by their means have been made by modern Aſtronomers, who therefore may be ſaid,

Admoviſſe oculis diſtantia ſidera noſtris,
Ætheraque ingenio ſuppoſuiſſe ſuo.

Such as are, 1. The Conjunction of *Mercury* with the *Sun.* 2. *Venus* having her phaſes like the *Moon.* 3. The Body of the Moon appearing like an other Earth, full of Mountains and Vallies, Seas, Rocks, Iſlands, Lakes, Forreſts and vaſt Plains; as alſo the Libration of the *Moon.* 4. Spots in the Sun. 5. The Four Satellits of Jupiter. 6. A Satelles of Saturn, and Rings about the ſame. 7. Several Belts about Jupiter, and divers Spots in *Mars*, *Venus*, &c. 8. The *Milky way* nothing but an innumerable company of ſmall Stars, near to one another. 9 The finding an Eclipſe to begin and end ſooner when obſerved with the naked Eye, than when ſeen with a Teleſcope; as alſo, that it appears always leſs by a *digit*, being obſerved by the bare Eye, than it is indeed. 10. *Pleiades* conſiſting of many more Stars than *Seven.* 11. *Orion* having 80 other Stars beſides thoſe three in his *Belt*, and the ſix in his *Sword*: And the ſame having in his head 21, inſtead of the one, called the *Nebuloſa.* 12. The Obſervation of many New Stars, as in *Caſſiopæa*, in *Cete*, in *Cygno*, *Andromeda*, &c. Here the Author taketh occaſion to intimate, that the rich Blew of the Sky ſeems to be nothing elſe, but a Confuſion of the mixture of lights diffuſed by that innumerable number of Stars, diſperſed through the whole extent of that immenſe profundity of the Æthereal Region.

12. Teaches a new way, of uſing a Teleſcope for drawing in proportion all the new Appearances in the Heavens; for meaſuring the Bodies of the Planets, and of the Fixt Stars themſelves and their diſtances, in ſuch parts, that a *Line* (the twelfth part of an inch) ſhall contain a 1000 of them; an inch (the twelfth part of a foot) 12000, and a foot, 144000: Beſides, a very eaſie and certain way of making all theſe parts (though very ſmall) perceptible to the bare Eye.

So far of the *firſt* Head of this *Third* Part.

The *other* Head is the *Mechanical*, ſhewing the ſeveral ways of Forming and Poliſhing all ſorts of Glaſſes, that ſerve for Teleſcopes; which is done in *ſix* Sections.

1. Rectifies the *Common* way of forming Glaſſes Spherically, and all the Moulds, in which the Vulgar Artiſts are wont to work them.
2. Teaches a way of excellently forming and poliſhing ſuch Glaſſes by hand, without any Engin.
3. Teaches a way of working Glaſſes by the hand guided by a ſimple Engin.
4. Treats of the working of Glaſſes by Inſtruments and Engins, regulating and directing the hand.
5. Teaches a New way of working Spherical Concave Eye-glaſſes, to ſerve Teleſcopes of the firſt kind, above-mentioned.
6. Teaches a New way of working all ſorts of Spherical Glaſſes, Convex and Concave, for Teleſcopes, very univerſally, ſpeedily, with eaſe, and in a ſmall room; even for the longeſt Tubes.

All which the Author concludeth with a Direction for a way of making Tubes that may ſerve to fit up Teleſcopical Glaſſes.

ERRATA.

In *Numb.* 74. p. 2221. l. 25. r. *is by Bruerus deſcribed to Muffet.*
In this *Numb.* 78. p. 3028. l. 22. r. *predicted*, for *practiſed*. p. 3029. l. 16. *& unum.* ibid. l. 25. r. *ſpectarentur*.

LONDON,
Printed for *John Martyn*, Printer to the *Royal Society*. 1671.

TO THE ILLUSTRIOUS The LORD HENRY HOWARD OF *NORFOLK*, &c.

MY LORD,

I *Have good aſſurance, that I ſhall not have need to ſay much in Juſtification of this Adventure; or to deviſe Reaſons, why I hold my ſelf obliged to addreſs this* Volume *to your Lordſhip. I may, I think, preſume on the* one hand, *that notice will be ſoon taken, that we have here aſſerted and vindicated our care for the* Reſuſcitation *of* Inſtructive Antiquities; *for the* Promotion *of* Arts *and* Sciences; *for the diligent* Perluſtration *of the* Chief parts *of the* World; *together with ſome not un-accurate Reſearches for good Models of* Artifice, *and for many Excellencies of* Nature; (*as will appear in the* Preface, *and in ſeveral of the* Tracts *following thereupon.*) *And ſure I am that on the* other hand *it will be conſider'd, that Your Lordſhip as well by your* Hereditary *Claim, as by your* Perſonal *Inclination and Addiction is pleaſed to be very affectionatly concern'd in all theſe Reſpects; that due Veneration may be given to the* Antient *and Firſt Inventors; and that* Modern *Induſtry be not diſcouraged, but that all advantages be imported from the remoteſt Diſtances of* Time *and* Place, *for the benefit of our own Country, and for Poſterity. Now from theſe Conſiderations I think I may have good hopes, that this my humble Oblation will not be accuſed of any Incongruity, though it be too mean to teſtifie the devotion I bear and owe to your Lordſhip.*

My Lord, *we are bound, on all occaſions to commemorate the Honour, you have done the* Royal Society, *by entertaining them in* Arundel-houſe, *as in a* Princely Colledge, *ever ſince they remov'd from* Greſham; *and for endowing them with a rich and un common* Library; *and for your manifold and great merit in the Advancement of* Learning: *A part of which is recorded in the* Archives *of* Oxford.

Your Incomparable Grandfather, the Renowned Earl Marſhall *of* England, *and* Earl *of* Arundel *and* Surrey, *was in his time acknowledged the* Preſident *and* Fautor *of the Nobleſt Diſciplines, and had the Curioſity and Felicity to collect many of the moſt conſiderable Monuments of the* Primæval Monarchies, *and thereby to enrich this Kingdome with the moſt Antient* Sculptures, *and the moſt Excellent* Paintings. *And ſuch of theſe Monuments, as were proper for the* Theater *of that Univerſity, the famous MARMORA ARUNDELIANA, your Bounty hath placed there as in the fitteſt Seat to ſucceed in the poſſeſſion of the* Remains *of* Old Greece *and* Athens.

But becauſe theſe Glories are too reſplendent for the baſhfulneſs of my Proſe, I ſhall reſign to the Elogy of our late Pindar, *who, when the* Oxonian Theater *was firſt ſolemnized, after he had in his* Pindaric *raptures celebrated the Heroical Vertues of your Moſt Illuſtrious Progenitors*, Dukes *of* Norfolk; *amongſt other great Attributes, juſtly appropriated to your Lordſhip, left us this* Memorandum;

——Clarior emicat
HENRICUS, genuinus Hæres,
Sublimis Columen domûs:
Antiquitati pandit lumen obſcuræ
Tenebráſque demit Hiſtoriæ.
Majoribus Poſteriſque partitur
Largus Influxum bifidum, vetatque
Illis Præteritum deeſſe, vel *his* Futurum.

Conquerors, Emperors, and Crown'd Heads, even when they have perform'd things truly great and worthy of renown, have ſometimes paſſed over the Stage as in a Dumb Shew, ſcarcely mention'd in any Authentick Hiſtory: *But the Muſes do never forget to conſecrate their Votaries*, Philoſophers; *and their own Patrons. And* good Letters *and* Arts *are more laſting than* Marbles. *And they, who recover Life to the beſt Literature; who reſtore, and preſerve, and excite Arts, and who give a longer duration to the moſt laſting Monuments; Theſe may Juſtly claim for themſelves the faireſt and moſt durable Monument, in the perſuaſion of,*

My LORD,
Your Lordſhips
Very Humble and Obedient Servant

London,
Febr. 19. 16$^{71}_{72}$.

Henry Oldenburg Soc. Reg. Secret.

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SIR,

I Am very much pleaſed, when you give me to underſtand, that ſomthing is publiſhed of the *Anatomy* of *Vegetables*, and that more is deſigned by that excellent perſon Signior *Malpighi* *. And ſince the receipt of your laſt, I have peruſed the very ingenious Book of Dr. *Grew*; and, as far as I have obſerved theſe matters, all things therein are faithfully delivered, and with great ſagacity. In turning over my Notes, made ſome years agoe, I find, among other things of this nature, ſome few Obſervations concerning the *Veins* of Plants or ſuch *Ductus*'s, as ſeem to contain and carry in them the nobleſt juices of Plants. Of theſe there is little or no mention made in this curious *Tractate*, unleſs under the notion of *Pores*. And becauſe I am of the opinion, that they will prove veſſels Analogous to our *Human Veins*, and not meer *Pores*, they ſhall, if you pleaſe, be the ſubject of your entertainment in this Letter; and the rather that, if they prove *Veins* (as I little doubt them) they are not to be paſſed over in ſilence, but are early to be accounted for in the Anatomy of *Vegetables*.

To avoid ambiguity; Thoſe parts of a Plant, which *Pliny* (*lib.* 16. *cap.* 38.) calls by the names of *Venæ* and *Pulpæ*, are nothing elſe, in my opinion, but what our late late Author, Dr. *Grew*, calls *Fibres* and *Inſertments*, or the *Lignous* body interwoven with that which he takes to be the *Cortical*, that is, the ſeveral diſtinctions of the *Grain*. Now, that the veſſels, we are about to diſcourſe of, are not any of the *Pores* of the *Lignous* body (to uſe the *Doctors* terms) is plain in a traverſe Cut of *Angelica Sylveſtris magna vulgatior J. B*, for example; the Veins there very clearly ſhew themſelves to an attentive view to be diſtinct from *Fibres*, obſervable in the *Parenchyma* of the ſame Cortical body together with themſelves; the Milky juice ſtill riſing *beſides* and not *in* any *fibre*. Alſo in the like cut of a *Burdock* in *June*, the like juice ſprings on this and on that ſide of the *radii* of the Woody circle, that is, in the *Cortical* body and *pith* only. Again, where there is no *pith*, there is none of this juice to be obſerved, and conſequently none of theſe *Veins* as in the Roots of plants, and Trunks of trees; but ever in the *Bark* of either. I need not here enumerate the many Plants, wherein theſe particulars are moſt plainly obſervable, as in *Sphondylium*, *Cicutaria*, many of the *Thiſtle* kind, *&c.*

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* *This Learned and Accurate Philoſopher hath already preſented to the* R. Society, *in a very obliging manner, his* Manuſcript, *containing the Sum of his Obſervations and Labours about the* Structure *of* Plants; *and he hath alſo very generouſly engaged himſelf, that, upon the Apppobation of that Illuſtrious Body, he will enlarge his Papers, illuſtrate all the particulars, therein contained, with* Scheams, *and then publiſh the whole.*

Further, Neither are they probably of the number of the *Pores*, deſcribed by our Author in the *Cortical* body, or *Pith*. Not ſurely of thoſe *Pores* extended by the *breadth*, becauſe the courſe of the juice in theſe veſſels is by the *length* of the plant; as I have ſometimes very plainly traced in the pith of a dryed *Fennel-ſtalk*, following them by diſſection quite through the length of the pith. It remains, that, if *Pores*, they are of thoſe pores of the *Cortical* body, that are ſuppoſed to be extended by the *length* thereof; which yet ſeems (to me at leaſt) not enough, but we think them veſſels inveſted with their own proper membranes, analogous to the Veins of our Humane body; for theſe reaſons: 1. Becauſe they are to be found in the *Pith*, and ſometime in the *Cortical* body of a plant, not included within the *common* Tunicle of any *Fibres*, as is above noted: (that Fibres, or the Seminal root are cloathed, is moſt plain in ſome plants, as in *Fern* and *Geranium Batrachoides*, the Fibres of the former are coated, at leaſt in ſome parts of the plant, with a black skin, in the *latter* likewiſe with a red one:) And in theſe caſes, had they not, I ſay, their own proper membranes, we ſee no cauſe, why the very porous and ſpongy body of the *Pith* and *Cortex*, ſhould not be in all places filled alike with the juice, and not riſe (as moſt plainly it doth) in a few determinate and ſet places only, that is, according to the poſition and order of theſe veſſels. 2. Again the Experiment I made, which you were pleaſed to publiſh *, concerning the effect of

* See *Numb.* 70. p. 2122, & 2123.

of a ligature on *Cataputia minor Lobel.* viz. the ſudden ſpringing of the Milky juice out of infinite pores beſides the Inciſion: (the cauſe of which *Phœnomenon* I take to be, the diſſected veins impetuouſly diſcharging themſelves of part of their juice within the porous *Parenchyma* of the Bark;) whence it is probable, that, if there was no coated veſſel to hold this milky juice, we might well expect its ſpringing upon the bare ligature, as when we ſqueez a wet Sponge; the external Cuticle of the plant, as this Experiment ſhews, being actually perforated.

In the next place it is very probable, that theſe veſſels are in *all* Plants whatſoever. For, as it is truth-like of all the other *ſubſtantial* parts of plants, that they are actually in, and common to all plants, though ſpecified by divers accidents in Figure and Texture; ſo of theſe *Veins*, which, though they be diſcernable moſtly in thoſe plants where they hold *diſcoloured juices*, yet we may very probably think, that they are wanting, where the eye finds not that aſſiſtance in the challenging of them. As in theſe very plants, where they are *leaſt* viſible, there is yet a time when they are, if not in all, yet in ſome parts of theſe plants, plain enough to the naked eye: The tender ſhoots of the Greater and Leſſer *Maple*, in *May*, are full of a milky juice; *viz* the known liquor of theſe Veins. Again to this purpoſe, If you apply a clean knive-blade to a travers cut of the like Shoots of *Elder*, the Gummy liquor of theſe Veins will be drawn forth into viſible ſtrings, as is the nature of Bird-lime, of the bark of *Holly*, or the milk of *Cataputia minor Lobel.* Further, The leaf-ſtalks of our *Garden Rubarb* do ſometimes ſhoot (by what accident, we enquire not here) a tranſparent and very pure Chryſtallin *Gumm*, though the Veins, that held this gummy juice, are by no ordinary means viſible in them, and yet by comparing the nature and properties of this Gum, with that of the Gums of other Vegetables, we cannot doubt but this *Gum-Rubarb* is the juice of theſe Veins, as well as we are aſſured, the Gum of other Vegetables to be of theirs, by the ſame comparative Anatomy. Laſtly, we think, that even *Muſhromes* (that ſeemingly inferiour and imperfect order of Vegetables) are not exempt and deſtitute of theſe Veins, ſome of them yielding a milky juice, hot and fiery; not unlike ſome of the *Spurge* kind, or *Euphorbium.*

It might be expected, that I ſhould add, ſomethings at leaſt, concerning the Original and Productions of theſe Veins, if not an exact deſcription of them, the courſe of the juices in them, and their more immediate and primary uſes in the matter of Vegetation: But I muſt acquaint you, that (beſides the ſeaſon is not now proper to improve and verifie, if I had leiſure, the Obſervations formerly noted, and that they were things thrown into my *Adverſaria* without other order, than that nothing ſhould ſlip from me in the queſt of Medicaments, that might be of light) although I find indeed many ſcattered particulars (beſides them already delivered) concerning the Poſition, Order, Number, Capacity, Diſtributions, Differences, Figure, *&c.* of theſe Veins; you will be pleaſed to take in good part, if I think fitting to reſerve them until the opportunity of another Summers review: It ſeeming to me no ſmall matter, to have fairly hinted the exiſtence of them to ſuch curious perſons as ſhall have the leiſure, and find themſelves in better circumſtances, than I can pretend to, as to thoſe great advantages of Glaſſes. Deſigning, *&c.*

To conclude with the *primary* uſe of theſe *Veins;* which is, in my opinion, to carry the *Succus nutritius* of *Plants*, becauſe, where they are not, there is no Vegetation; as it is ſeen, if an engrafted Branch or Arm be bared and ſtripped off the clay, *&c.* in *June*, all the courſe of Vegetation will appear to have been made only by the *Bark*, and not by the *Wood*, that is, in the place only, where theſe veins are. A *ſecondary* uſe is the rich furniture of our Shops; for, from theſe *Veins* only it is, that all our *Vegetable Drugs* are extracted, and an infinite more might be had by a diligent enquiry, and ſome eaſy means, which I have not unſucceſsfully put in practice; witneſs the *black Reſin*, I not long ſince ſent you a ſpecimen of.

An Account of the Speaking Trumpet, *as it hath been contrived and publiſhed by Sir* Sam. Moreland *Knight and Baronet; together with its Uſes both at Sea and Land. Printed at* London *An.* 1671.

THe Author of this Inſtrument relateth *firſt* the ſeveral Tryals made with it; of which the moſt conſiderable was, that the biggeſt of thoſe that have been as yet employ'd, turn'd Trumpet-wiſe, being 5 foot 6 inches long, and of 21 inches diameter at the great end, and 2 inches at the little; When by his Majeſties ſpecial command it was tryed more than once at *Deal* Caſtle by the Governour thereof, the voice was plainly heard off at Sea, as far as the Kings Ship's uſually Ride, which is within two and three miles, at a time, when the wind blew from the ſhore.

Next, He diſcourſeth of the Nature of Sounds, and the Manner, How he conceiveth them to be magnified or multiplyed by this Organ. Where he obſerveth, 1. That a ſmall Tube (*e.g.* that of an ordinary Trumpet) does not at all magnifie Sounds, Words, or Syllables. 2. That 'tis neceſſary, the diameter of the leaſt end of one of theſe Inſtruments be equal to (if not greater than) the diameter of the orifice of the Speakers mouth, and that what it wants of that, ſo much the leſs does the Inſtrument magnifie the Voice. 3. That the Inſtrument muſt be enlarged by degrees, and not too ſuddenly. 4. That the Mouth-piece of it muſt be ſo applyed and adapted to the Speakers mouth, that no Air or Breath be loſt, and yet the Mouth have free liberty of opening and ſhutting, that ſo the Articulation be entirely preſerv'd. 5. That the Point, where the voice is moſt magnified, is the Center of its greater Orifice. 6. That the turning and winding of this Inſtrument, either Trumpet-wiſe, or in any other Circular figure, is ſo far from prejudicing it, that it the rather ſtrengthens the voice. 7. That (as he with ſubmiſſion conceives) the Voice, as it is tranſmitted through this Inſtrument from the Mouth, endeavors all the way to ſpread and dilate it ſelf by Spherical Undulations; but finding Oppoſition on every ſide, maketh a percuſſion in every point of each imaginary circle of the Tube; and again, that the percuſſion made in every ſuch Circle, being reundulated to the Center of each of them, maketh there a much ſtronger percuſſion than that which was made in any ſingle point or part of ſuch Circle, foraſmuch as it may be preſumed, that all the percuſſions, made in any of thoſe Circles, are united in their ſeveral Centers; and that the percuſſion in the Center would again dilate it ſelf by a Spherical Undulation, but meeting with oppoſition in every point of the Tube, an entire Cone of imaginary rays of Sound are reverberated to ſome Center, in like manner as the Sun-beams are reverberated from a poliſht ſuperficies of a *parabolical* Concave to its proper *focus*. And that therefore, as the Tube enlarges it ſelf, and the Circles both of Reundulation and Reverberation become greater, there muſt needs be imagined (according to him) a greater number of Reundulating Circles and Reverberating Rays, to meet in each reſpective Center and *Focus*, whereby the ſame voice is greatly augmented. 8. As to the Demonſtrative part of this Tube, and the exact Figure and Dimenſions of it, he propoſeth to Mathematical Philoſophers this Problem, *viz.*

> *What is the Right-lined, Curvi lined, or Mixt Figure; and what are its exact Dimenſions; and what the Sphere of its activity, that beſt and moſt magnifies Human Voyce?*

Laſtly, He ſubjoins the Uſes of this Inſtrument; as, 1. *That* in a Storm, or in a Dark night, when two Ships dare not come ſo near one another as to be heard by any ordinary voice, by this Tube they may very eaſily ſpeak together at half a mile or a miles diſtance, or more, if need be, eſpecially if alternately they take the advantage of the Wind: And if that be ſo ſtrong, that but one of the Ships can ſpeak with the Wind, the other may anſwer by ſigns, though directly againſt it. 2. In a Storm it is of good uſe in a ſingle Ship, for hearing one Man giving order to all in a Ship. 3. By it an Admiral may in a Calm give immediate Orders to his whole Fleet; as alſo a Governour may convey his Orders from a

Sea-Fort to Ships riding at a pretty diſtance in the Road. 4. In caſe of a cloſe Siege, by this Inſtrument, at one, two, or three miles diſtance, the *Beſieged* may be told, by ſpeaking in *Cypher*, that there is Relief coming, and how great, and when: And, on the other ſide, the *Beſiegers* may thereby threaten and diſcourage the *Beſieged*, in a ſpatious Town. 5. By this means a General may ſpeak himſelf to his whole Army; an Herald may make a proclamation, to be diſtinctly heard by many thouſands; an Overſeer of Works, give orders to many hundreds of Workmen, without changing his ſtation; Officers and others, in caſe of a great Fire, where uſually people are in an hurry, may ſo govern the Aſſiſtants as to prevent diſorder and confuſion; Houſe-keepers, in caſe of Thieves attacking an Houſe remote from Neighbours, may immediately call upon all the Dwellers round about, within a mile or more, and inform them of the Houſe where the robbery is made, the number of the Thieves, how dreſſed and armed, and which way they are gone, *&c.*

The Author doubts not but this Invention may be much improved: But, as to his *Probleme* above-expreſſed, it ſeems, to us, that that muſt be ſetled by Experience (rather than Demonſtrations,) there being a complication of ſo many *phyſical* Accidents, that the neglect of ſome one Un-heeded, may ſoon defeat a demonſtration, deduced from ſome other of them.

Fig. I

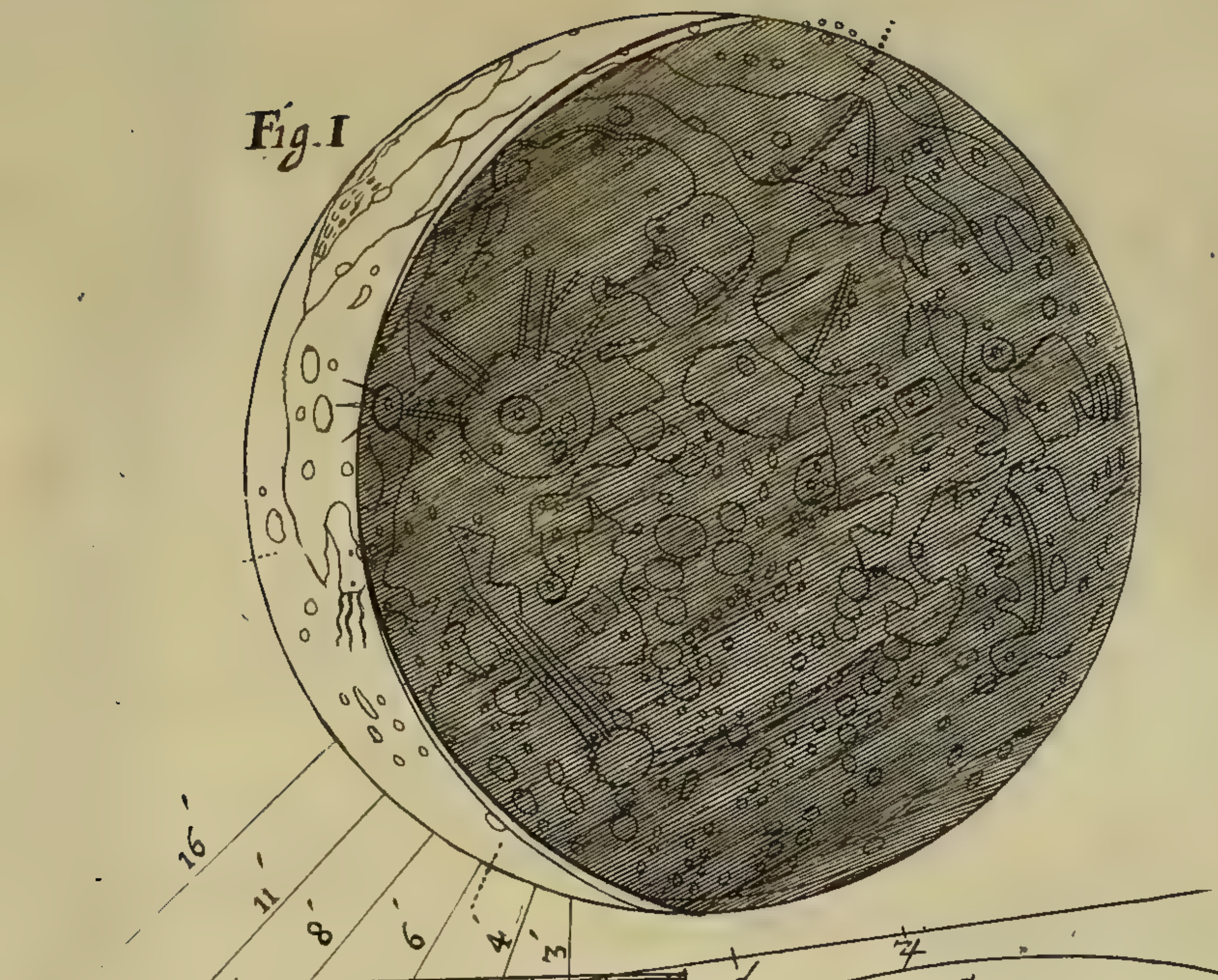


Fig. II

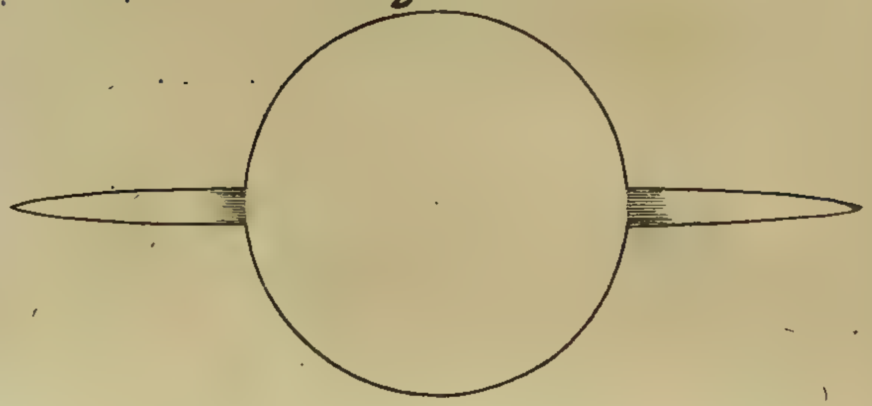
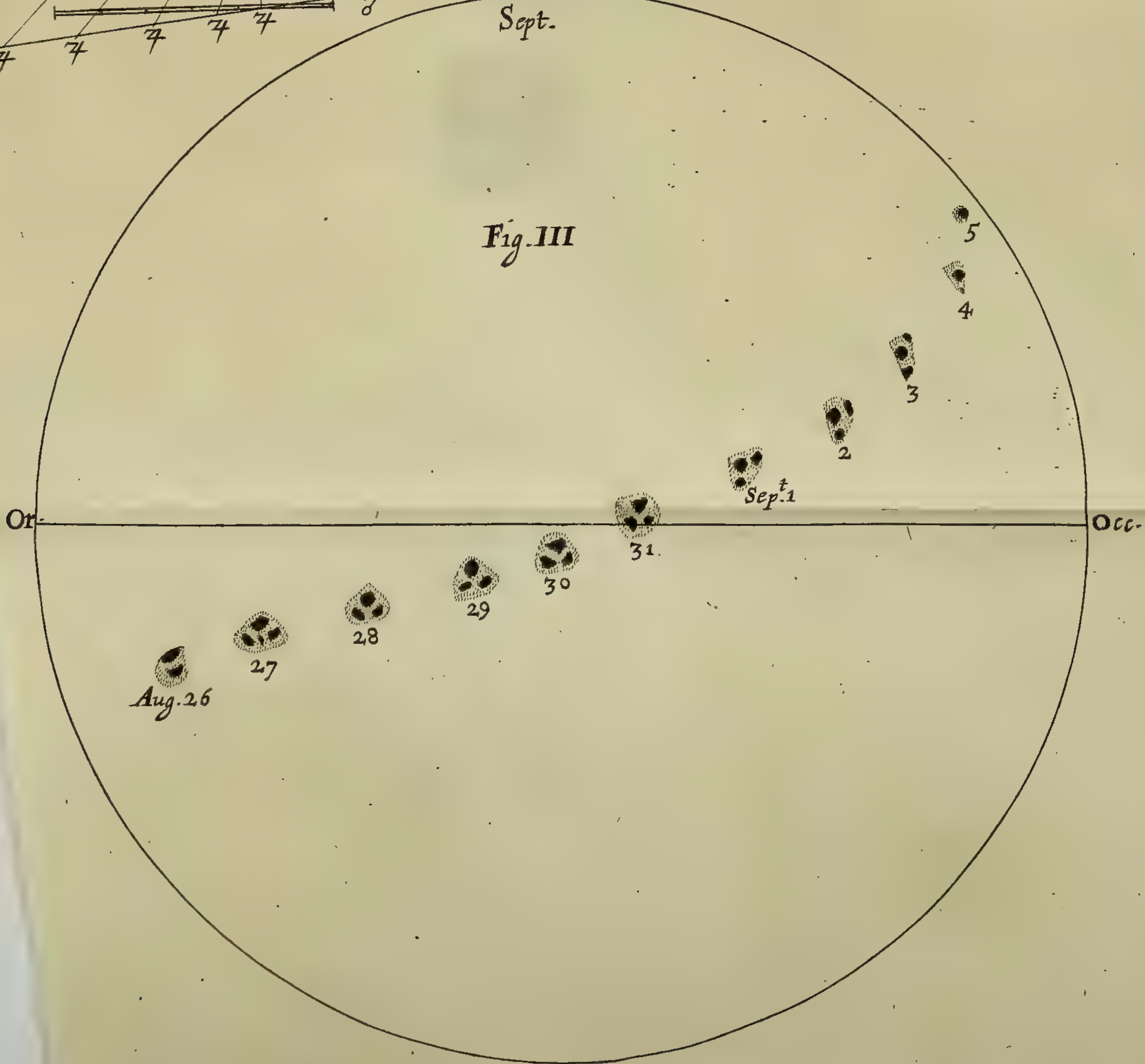


Fig. III



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BRITISH MUSEUM
NATURAL HISTORY

An Obſervation and Experiment concerning a Mineral Balſom, *found in a Mine of* Italy *by Signior* Marc-Antonio Caſtagna; *inſerted in the* 7th. Giornale Veneto de Letterati *of June* 22. 1671, *and thence Engliſh'd as follows*;

IN the Territory of *Bergamo*, Signior *M. Ant. Caſtagna* upon the confines of his Juriſdiction, lighted accidently upon a not ordinary ſweet Balſamick Scent, and following the ſame ſo as to find the Spirits thereof to ſtrike his noſe more and more ſtrongly, he firſt cauſed that Rocky Hill, where he then was, to be digged in the place that appear'd to him moſt likely to be the Seat of it, and found, that the Stones thereof harbour'd that fragrancy he ſmelt, which was ſo ſtrong, and by trials found ſo friendly to the *Uterus*, that being applyed they did in a very ſhort time cure it of any evil, 'tis ſubject to. Encouraged hereby to proſecute this work, he made his Workmen digg into the very bowels of the Hill, and after much labour and charge diſcover'd holes in ſome ſtones, as if excavated by art, of a greeniſh colour, in which he found, as diſtilled by nature and kept in veſſels, that liquor and balſom, which proved the ſource of that ſcent, which was limpid and of a white colour, like the white of an egg, but ſomewhat oleaginous, floating upon all ſorts of liquors like oyl. Beſides, he met in the ſame Cavities ſome ſmall grains concreted of the ſaid liquor, reſembling that which they call white Amber; which, being Chymically diſtilled, had the ſame odour with the Balſom. This raiſeth the curioſity of many, to know what rich Ore may be lodged amongſt or under thoſe ſtones.

Two Obſervations made by P. Franceſco Lana, *the Author of the* Prodromus *premiſed to* Arte Maeſtra *, *concerning ſome of the effects of the* Burning Concave *of* Lions; *and alſo an odd Salt extracted out of a Metallic ſubſtance: Taken out of the ſame* Venetian *Journal.*

* *Spoken of in* Numb. 69.

THe *firſt* is, That the ſaid *Fr. Lana* having been inform'd, that that famous *Burning Concave*, not long ſince made by M. *de Vilette*, did much ſooner melt Iron, than Gold or Silver; he eſteems it worth conſidering, why a Kitchin-fire doth the contrary, melting Gold ſooner than Iron? Whether it proceeds thence, that the Aſtral heat of the Sun is dryer than our common fire, having much humidity in it; whence Gold being moiſter than Iron, may more reſiſt the dry celeſtial heat of the Sun, than Iron and the reſt of the dryer Mettals can do? Or, Whether Gold, being of all Mettals we know of, the longeſt a producing and perfecting by the Solar heat, ſo 'tis alſo longeſt a diſſolving by the ſame? *&c.*

The *other* is, that the ſaid P. *Lana*, having extracted out of a Metallic Subſtance a very white Salt, the ſame was, upon the application of the gentleſt heat, reſolved into a Golden-colour'd liquor; which being removed from that warmth, as ſoon as it felt the cool Air, and even by opening the Glaſs wherein it was incloſed, did in a moment ſhoot afreſh into the ſame Salt;and that (which ſeem'd oddeſt) whilſt he was pouring it out of one glaſs into another during its fluidity, it was diſperſed all over the glaſs it was poured into, ſuddenly congealing into moſt fine threds, many of which were extended from one ſide of the glaſs to the other, and,hanging as 'twere in the Air, formed juſt like the ſubtileſt Cob-webs, not at all rigid, but, by reaſon of their exquiſite ſubtlety, pliable, and ſcarce perceivable by the Eye.

De *Lunæ* ad *Pleiadas* reliquas Applicationibus, Anno 1672 obſervandis, promiſſa appendicula *Johannis Flamſteed.*

T*Andem, Clariſſime* Oldenburgi, *promiſſi memor, tempora reliquarum applicationum* Lunæ *ad* Pleiades, *Anno* 1672 *viſibilium, craſſius editis Schedis exhibita, præcisè hic indigitata ad Te mitto: Stellis loca aſſignavi infra ſcripta ex nuperis, &, ni fallor, accuratis obſervationibus; media prius lucida, eodem omnino loco, & latitudine donatâ, quæ Authori* Carolino *(cujus in ſupputando utor numeris) utique arrideat; cæteris etiam abinde diſpoſitis; quas tamen omnes, propriam ſi hac in re ſententiam ſequi licuiſſet, tres vel ſaltem duos ſcrupulos primos promotiores, nec non & latiores ab Ecliptica proponerem: Ineunte Anno* 1672 *conſtitutæ;*

Pleiadum.		Long. ♉ °	'	"	Lat. Bor. °	'	"	
Occidentalis lucidior ———————	b	24—45		15	4	8	51	5
Intra hanc & Borealiorem Teleſcopicam	g	24—46		47	4	19	21	8
Occidentalis Borealior ———————	c	24—54		48	4	28	19	6
Supremi in Quadri latero ———————	e	25—01		24	4	20	39	5
Infima Auſtralis oppoſita ———————	d	25—02		18	3	53	59	6
Media & lucida ———————	a	25—19		48	4	00	00	3
Quæ in cuſpide ad ortum ———————	f	25—41		29	3	52	19	5
Orientalium ſuperior teleſcopica ———	h	25—42		55	3	56	51	7

Inde cum Feb. 23 *paulo ante mediam noctem appulſum ad haſce Luna faciet, Mediam Auſtrino limbo præcisè tacturam comperio, cum prius Occidentalem lucidiorem Borealiorem & ſupremam in Quadrilatero occultaverit.*

Etenim Londini,

Hor.	'	"				Lat. ✱ᵃ à Cent. ☽ᵃ '	"	
11	01	00	*Occidentalis lucidior*	b	*tegitur*	12	30	*Auſtr.*
11	10	37	*Occidentalis borealior*	c	*abſconditur*	7	30	*Bor.*
11	18	04	*Suprema in Quadrilat.*	e	*occultatur*	0	16	*Bor.*
11	41	48	*Occidentalis lucidior*	b	*prodit*	9	40	*Auſtr.*
11	57	17	*Occidentalis borealior*	c	*emergit*	10	11	*Bor.*
12	12	10	*Suprema in Quadrilat.*	e	*evadit*	3	20	*Bor.*

Præterea via Lunæ viſibilis, & ſi verſus Orientales inclinatur, vix tamen eas, ob minores latitudines, limbo Auſtrali tanget, credo.

Iterum Auguſti 6, *manè Luna rurſus Stellas* e & c *conteget nobis, ſic ut horis à media nocte præcedente fiant*

h.	'	"				h. '	"	
1	31	26	*Occidentalis borealioris*	c	*obtectio:*	3—42		*Bor.*
1	41	29	*Supremæ in Quadrilatero*	e	*occultatio:*	5—16		*Auſtr.*
2	39	23	*Occidentalis borealioris*	c	*emerſio:*	2—37		*Auſtr.*
2	45	16	*Supremæ in Quadrilatero*	e	*evaſio:*	10—50		*Auſtr.*

Denuo Octobris 26, *paulo ante mediam noctem eaſdem duas noſtro conſpectui ſurripiet ; ut*

h.	′	″			′	″	
11	33	24	c	*Occidentalis borealior abſcondatur :*	0	14	*Bor.*
11	51	52	e	*Suprema in Quadrilatero occultetur :*	8	24	*Auſtr.*
12	41	29	c	*Occidentalis borealior eluctetur :*	3	18	*Auſtr.*
12	46	37	e	*Suprema in Quadrilatero exſplendeat :*	11	14	*Auſtr.*

Poſtremo Decembris 20, *borealiorem occidentalem* c *ſubteget Luna, cujus conſpicietur p. m.*

	h.	′	″			′	″	
Occultatio —	9	02	36	*Lat.* ✱ *à Cent.* ☽ *in*	*Ingr.*	11	25	*Auſtr.*
Retectio —	9	50	44		*Emer.*	11	31	
Mora ſub Luna		48	08					

Interea ſuprema in Quadrilatero e *clarè extabit à Luna, quâ-cum ſecundum longitudinem conjungetur ſtellæ hora* 9^{h}. 40′. 17″, *quo tempore à centro Lunæ apparens latitudo* 19′. 10″, *Lunæ viſibilis ſemidiameter* 16′. 27″ : *Stabit propterea ſtella à limbo Auſtrino Lunæ* 2′. 43″. *ad Auſtrum. Quod an ita cœlitus fiet, an ſecus, inter cætera ſequentis anni Phænomena, cœlorum Studioſis obſervandum proponimus. Editæ porrò Synopſi, ii Lunæ motus adnectantur, quos ad tempora apparentiarum indaganda è dictis tabulis computavi, qui ſunt ;*

	Anom. med.	☽ *à* ☉ *æqu.*	*Arg. Lat.*	*Paral.*	*Semid.*	*Horoſ.*	☽ *Alt.*	*A.par.*
h. ′ ″	S. ° ′ ″	S. ° ′ ″	S. ° ′ ″	′ ″	′ ″	S. °	° ′	° ′
Feb. 23.12.12.40	5 21.55. 6	2. 9.54.59	2.11.54.46	63.42	17.13	♏ 25	4.27	42.30
Aug. 5.13.44.49	5.05.34.20	9. 2.03.20	2.17.35.57	63.10	17.14	♋ 21	38. 1	62.37
Octob. 26.13. 3.39	4.25.48.51	6.10.37. 4	2.23.56.43	59.24	16.18	♍ 7½	62. 0	67.53
Dec. 20.10.16.51	4.23.28.51	4.17.50.23	2.24.26.32	60.04	16.27	♍ 19	57.20	54.30

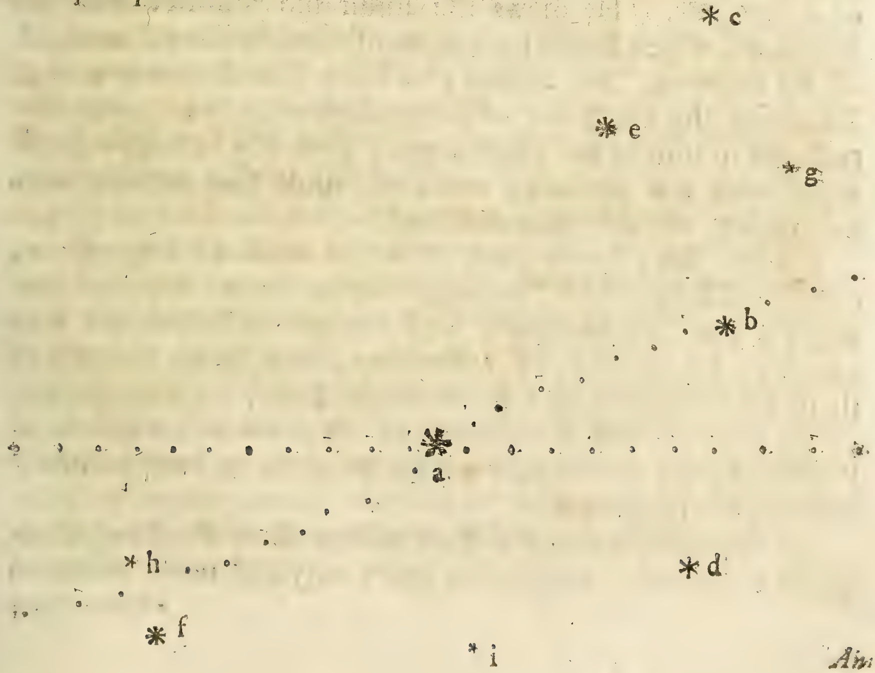
Sic cum opportunitates, tum commoda obſervationum præmonſtravi, quibus ſi ſedulo fidi Cœliſpices invigilaverint, nec ſuas nobiſcum obſervationes communicare gravati fuerint, hos labores ſat bene compenſatos arbitrabimur.

Veruntamen, ſi etiamnum quæras, è quibus obſervationibus Pleiadum loca ita reſtituerim, nec id Te celari velim. Tubum habeo pedum 13⅔, *lentibus convexis, & micrometore exactiſſimo* Townleiano (*mihi a viro cordato, & horum ſtudiorum amantiſſimo,* Jona More, *donato) inſtructum ; quo cum noctibus ſerenioribus menſium* Octobris *&* Novembris, *nuper elapſorum, minutas frequenter harum ſtellularum intercapedines dimenſus ſum, idque adeò auſpicato, ut nunquam* 20″, *imò perraro* 10″. *inter ſe diſſiderent repetitæ obſervationes ; à prægreſſis etiam defuncti D. Gaſcognii, & nuperis Generoſiſſimi* Townleii (*quantorum hominum !) eadem ratione peractis obſervationibus, confirmatæ ; quæ quidem diſtantiæ limatiſſimæ, & in locis Latitudinibuſque* Pleiadum *inveſtigandis uſitatæ ; ſunt,*

a b	35'	40''.	Muto *quæ*
a e	27	40	31'
e b	20	00	32
c b	21	45	22
e c	10	00	11
e g	14	40	
c g	11	55	
b d	22	04	24
a d	18	30	22
e d	26	10	30
d i	16	25	
a i	18	18	
f i	29	04	
f a	23	00	27
h a	23	20	
f h	4	45	4

Addit Vinc. Mutus *in Epiſtola ad Doctiſſimum* Ricciolum, *cujus meminit in Appendice ad* Almageſti Novi *Tomum primum pag.* 747: Occidentalem lucidiorem tranſiiſſe meridianum in eadem omnino altitudine ac Lucidam Pleiadum: *Quâ fretus adverſione haud difficile mihi fuit, invento prius angulo paralleli declinationis, cum parallelo latitudinis, triangulorum reſolutione, cæteras omnes ſtellulas locis debitis & datis donare.*

Monendum tantummodò, me ſtellam Teleſcopicam i, *(nonæ circiter lucis, quæ ſecunda eſt quarundam in linea detorta à Media & Lucida perpendendentium, & reperitur in* ♉ 25°. 14'. 4''. *cum latitudine* 3°. 42'. 37''; *) propterea meis obſervationibus adſciviſſe, ut ejus adjutorio ſtellas,* f & h, *locis debitis accuratius diſponerem; quod abſque ea affectum dare admodum difficile fuiſſet, quam propterea, cùm ulterius uſui eſſe non poſſit, cum cæteris antea non numeravimus. Interim ſi plurimùm à* Tychonicis & Mutianis *locis*, noſtri *diſſidere videantur, nec nobis id culpæ verſum velim, nec illis, qui, noſtris deſtituti ſubſidiis, Tubo nimirum, vel exquiſito Micrometro, in hanc præciſionem ſuas provehere obſervationes neutiquam potuerunt.*



Ain

An Account of ſome Books.

I. *ELEMENS de GEOMETRIE*; *par le P.* Ignace Gaſton Pardies, *de la Comp. de I.* *A* Paris 1671, in 12°.

THe Learned Author of this Tract declareth, that in it he hath given a ſhort and eaſy Method to learn what is neceſſary to be known of *Euclid*, *Archimedes*, *Apollonius*, and of the beſt Inventions of the Ancient and Modern Geometricians. Of which Method he hath now publiſh't the firſt 9 Books; reſerving to another time the remaining *Seven*, which, *he ſaith*, are to explain the more profound and ſublime inventions of this Science, but are not ſo neceſſary to thoſe, that have a mind to *begin* the Study of it; for whoſe greater conveniency he ſeems to have taken the pains to divulge this firſt part, In which he treateth of what he thought moſt conſiderable in the 15 Books of *Euclid*; and beſides, What *Archimedes* hath demonſtrated of the Quadrature of the Circle, as alſo the Doctrine of Logarithms, of *Sinus*'s, *&c.* He ſhews the admirable proprieties of the Numbers, which *Euclid* hath demonſtrated in the 7,8, and *9th.* of his *Elements*. He affirms, to have found a new way of Teaching the Doctrine of *Incommenſurables*, and given Directions in four or five ſmall pages, perfectly to comprehend what very few perſons, even of thoſe that meddle with Geometry, are able to underſtand.

Beſides this, he treateth of divers kinds of *Progreſſions*, chiefly inſiſting on the Two moſt famous ones, *viz.* the *Geometrical* and *Arithmetical*; and comparing them one with another, he treateth of *Logarithms*, and ſhews the Art of them by the means of a Geometrick Line, by him eſteem'd very uſeful for the Reſolution of all ſorts of Algebraical Problems; by the help of which he ſaith to have formerly ſquared the *Hyperbola*.

He concludeth this *firſt* Part with a ſhort *Practical* Geometry; wherein, beſides the more eaſy and more common

Operations, he ſaith he hath delivered the Principles not only *of* meaſuring the Magnitudes and Diſtances of places Inacceſſible; *of* making the Map of a place or a province; *of* finding the *Sinus's*, *Tangents* and *Secants* of all Angles; but in ſhort, *of* coming to the Knowledge of what ever appertains to this part of Geometry.

In his *Preface* he promiſeth to give us, *next*, his Algebra, his Doctrine of Conical Sections, Sphericks and Staticks; but, above all, to eſtabliſh Five or ſix General Rules, whence afterwards, by way of Corollaries, may be drawn the demonſtration of an Infinity of Propoſitions, which paſs for great ones in Geometry: Where, *he adds*, ſhall be found the nature and meaſure of *Aſymptotick* ſpaces, as the moſt admirable knowledge in the World; thoſe ſpaces being of an extent actually infinite, compriſed between two lines, which being infinitely prolonged do never meet; but of which yet it may be demonſtrated, that they are equal to a Circle or another determined figure; ſo that *Infinite* it ſelf, as immenſe and innumerable as it is, may notwithſtanding be reduced to a *calculus* and to a Geometrical meaſure, and that the Mind of Man, being greater than it, is capable to comprehend it; For ſince Imagination cannot attain ſo far as to repreſent unto us what is Infinite; the demonſtration, we make of the nature and proprieties of this immenſe and infinite Aſympotick extenſion, convinceth us at the ſame time, that we have within us a power capable to repreſent unto us this infinite Extenſion. For, *ſaith he*, as, for meaſuring with a Rule and Compaſs a Figure repreſented upon paper, I muſt have this Figure preſent to mine eyes and hands, that ſo, by applying the Inſtruments to its angles and ſides, I may take all the dimenſions of it, and ſo determine its Magnitude; even ſo, for taking with the rule of my Reaſon the meaſures of this Aſymptotick ſpace, I muſt have an *Idea* thereof inwardly preſented to my Mind, and this Mind by applying it ſelf, as it were, to this *Idea* and Interior figure, muſt take the dimenſions of it, determine its bigneſs, and demonſtrate all its proprieties, *&c.*

In the ſame *Preface* the Author deduceth largely, wherein his Method of Teaching *Geometry* differs from the Methods of others, as to facility and intelligibleneſs: which we forbear to tranſcribe, becauſe it would take up too much of that room, which we ſhall need for giving ſome account of Two other Authors.

II. *Regnerus de Graaf* de *SVCCO PANCREATICO.* *Lugduni Batavorum,* An. 1671, in 12°.

THat the Reader may not think, we twice ſerve up the ſame matter, foraſmuch as we may ſeem to have deſcribed this very Tract long ago, *viz.* in Numb. 10. p. 178; we muſt inform him, that *this Edition* is by the Author himſelf eſteem'd to deſerve in a manner the Name of a New Treatiſe, by reaſon of ſeveral New Obſervations added, and divers Objections ſolved therein. Beſides, that there is annexed to it the Author's Ingenious Letter to D. *Lucas Schacht*, Profeſſor of Phyſick at *Leyden*, *de Partibus Genitalibus Mulierum*; of which ſubject he therein ſummarily delivers, what he intends to compoſe hereafter a Book of.

De quo quidem Argumento ne nihil dicamus, linguâ minus communi rem totam, ab Authore hîc traditam, compendifacere ſtudebimus.

Ait itaque, Vaſa præparantia *Mulierum breviora eſſe quam Virorum:* Teſtes Muliebres *nullam cum Virilibus ſimilitudinem obtinere, cùm non ſint vaſcula ſeminaria, ſed perfectiſſima ova in ſe contineant, ad quæ vaſa præparantia excurrant:* Ova *in Teſtibus illis contenta fœcunda reddi, quatenus ſeminalis Aura, ex Vtero per patentes ejus Tubas ad Teſtes pervadens, in Ovis inibi latitantibus formentationem excitat; eòque ipſo Teſticulorum ſubſtantiam ad expellenda Ova diſponit, quæ à fimbria, Tubarum extremitate, excepta, per Tubas ad Vterum tranſeant:* Ligamenta *Vteri nil aliud eſſe quàm membranas multis vaſculis refertas quorum extremitates in pinguedine Pubis terminentur & evaneſcant:* Arterias Hypogaſtricas, *plures diſſeminare propagines ad Vterum, quàm ad Vaginam ejus; earum, quæ ad Vterum excurrunt, præcipuam*

miro ductu utrinque ad Vteri fundum pertingere, atque Arteriis præparantibus ſive ſpermaticis tam affabrè uniri, ut peritiores etiam Anatomici dubitare poſſint, utrum ab Hypogaſtricis, *an verò à* Præparantibus *Arteriis ſanguinem ſuum arterioſum Teſtes ac Tubæ hauriant:* Venas Hypogaſtricas, *etiam ad Vterum, Vaginam & reliquas partes tendentes, ſibi invicem tot támque patentibus nexibus copulari, ut inflatâ vel minimâ venulâ protinus totius Vteri, Vaginæ, Tubarum atque Teſtium venæ diſtendantur: Vtero ſecundùm longitudinem per medium diviſo, diſſectorum vaſorum orificia quamplurima conſpici, atque Vteri cavitatem tantùm unicam reperiri, eámque ab interno Vteri oſculo uſque ad magnam ſuam capacitatem rugoſam eſſe, pluribuſque foraminulis præditam, ex quibus, preſſo Vtero, pituitoſa & viſcida materia prodeat: Adhæc, in rugoſa Vaginæ tunica hinc inde etiam porulos conſpici, ſed longè pauciores ac minores, quàm in collo Vteri, niſi prope Vaginæ orificium, ubi, in Superiori inprimis parte, prope meatum urinarium, & in ipſo, tam magni ductus ſive lacunæ reperiantur, ut ſtylum craſſiuſculum admittant, ex quibus in ſalacioribus, non minùs quàm ex iis, qui ſunt in Vteri collo, materia ſeroſo-pituitoſa (impropriè* ſemen *vocata) cum impetu erumpit. Denique,* Clitoridi, *ut Membro virili, arterias, venas & nervos communicari, & quoad ſubſtantiam cum Pene virili aliquam ſimilitudinem habere; carere tamen Vrethrâ, & duobus tantùm Muſculis inſtrui, licèt plerique quatuor numerent; ſub horum Muſculorum carnoſis expanſionibus ſpongioſum quoddam reperiri corpus, ex multis vaſculis & fibrillis conflatum, quod propriâ membranâ cingatur, & ad latera Vaginæ, propè ejus orificium, ab inferiori parte ad membranoſam uſque Clitoridis ſubſtantiam utrinque aſcendat, uti, ſi infletur, conſpiciendum ſe præbeat.*

Hactenus Induſtrius juxtà ac Doctus hic Author; *Cujus ampliorem de hac materia Diſſertationem, fidis Obſervationibus & Experimentis nixam, impensè deſideramus; inprimis verò, ut liquidius, quàm hactenus factum, oſtendatur, quo ſcil. meatu Ova iſta quarumvis fæmellarum è Teſtibus in Tubas, & per Tubas, quæ aliquâ ſui parte imperviæ habentur, in Vterum devolvantur. Spes interim haud levis me fovet, Controverſiam hanc de mulierum Ovariis, cùm ea hoc ipſo tempore Peritiſſimorum quorumque in*

Anglia, Gallia, Belgio, &c. *Anatomicorum tribunali ſe ſtiterit, brevi ab ipſis, in rei Anatomicæ incrementum, penitus elucidatum iri. Vid.* Numb. 70. p. 2136.

III. *Phyſico-Matheſis de* LUMINE, COLORIBUS & IRIDE, *&c. Auth.* Franc. Maria Grimaldo *S.J.* Bononiæ, 1665. *in* 4°.

THis Learned Treatiſe was not to be altogether omitted in theſe *Philoſophical Occurrences*, though an Account of it hath been deferr'd (too long,) it being but lately fallen into the *Publiſher*'s hands.

The Author then finding, that much obſcurity was left in the Doctrine of *Light*, and eſteeming it rather commendable than preſumptuous, to endeavor the clearing of it, eſpecially if that be done by Experiments (which he judgeth an exceedingly conducive way for the Improvement of all Natural Knowledge;) undertaketh in Two parts to deliver his Tryals and Meditations on this Subject.

In the *Firſt* are contained the ſeveral Experiments, which may favour the Doctrine of the *Subſtantiality* of Light, together with the Ratiocinations thence ariſing.

In the *Second* is repreſented, What may be anſwered to all thoſe Arguments, ſo as to ſave the *Peripatetick* Opinion of the *Accidentality* of Light: Which yet is done in ſuch a manner, as that the Author leaveth a liberty to the Judicious Reader, to embrace which of theſe two Opinions he ſhall think the more probable.

But, more particularly, in the *former* part he explains, How many ways *Light* is propagated or diffuſed, *viz.* not only *directly*, and by *refraction*, and *reflexion*, but alſo by *diffraction*; which laſt, according to him, is done, when the parts of Light, ſeparated by a manifold diſſection, do in *the ſame medium* proceed in different ways. *Next*, he conſiders the Nature of Light, as alſo Diaphaneity, and Opacity; and taketh notice, that moſt Bodies, whether Solid or Fluid, are *porous*; on which occaſion he ventures to explain almoſt the whole Philoſophy of *Magneticks*. Then he diſcuſſeth the Queſtion, Whether the diffuſion of Light be *Inſtantaneous*, and concludeth it in the *Negative*, though the Duration of it be imperceptible. This done, he examines the nature of Reflexion and Refraction, and ſeems to acknowledge, that, ſuppoſing Light to be a *Subſtance* very fluid and very ſubtile, an account may eaſily be given, why it is reflected and refracted, and why it obſerves ſuch Laws in its reflexion and refraction, as really it doth.

Further, he diſcourſeth of *Colours*, and conſiders, How Light is changed into Colour, ſometimes by Reflexion alone, ſometimes by Refraction alone, ſometimes without either and without the change of the Medium, *vid.* by *Diffraction*. He explains alſo, How Light by the ſole intrinſick modification of it ſelf, paſſeth ſometimes into a colour that is commonly called *Apparent*: Where he declareth, that the reaſon, why Light paſſeth into an Apparent colour, is not ſome determinate Angle, at which the rays amongſt themſelves are inclined; but that that Colour is produced by the intenſion and denſity of Light. He teaches alſo, That to the Viſion of things permanently colour'd, there are not required any *intentional ſpecies*, tranſmitted from them, and contradiſtinct to Light; but that the Light, which is diffuſed, or at leaſt reflected from things colour'd, is ſufficient; yet with ſuch a Modification, as is to be found in Light *apparently* coloured: On which occaſion many particulars are delivered concerning *Reflex* Viſion, together with an Explication of that *Quære*, How the Place of the thing ſeen is perceived? *&c.* To all which is added, that the Modification of Light, by which it is both *permanently*, and (as they ſpeak) *apparently* coloured, or made ſenſible under the repreſentation of Colour, may not improbably be ſaid to be a determinate and moſt finely furrow'd Undulation of the ſame, and a kind of tremulous diffuſion, with a certain very ſubtle floating, whereby it doth, in a peculiar way of application, affect the Organ of Viſion: Which is illuſtrated and confirmed by what is by Philoſophers taught of *Sound* and *Hearing*. Upon which 'tis inferr'd, that Colours are not any thing permanent in viſible things, not of themſelves lucid, when they are not illuminated; but that they are the Light it ſelf, under ſome peculiar Modification made ſenſible by the Sight.

Laſtly, This firſt part is ended with a large Diſcourſe of the *Rainbow*, its Colours and their Order, its Circular figure, the Concentrickneſs of Rainbows, *&c.* Concluding upon the whole, that a Rainbow, both the Primary and Secundary, is generated from the Solar rays, reflected and refracted by the drops of a rorid cloud, ſo that the *Primary* is repreſented by the rays that are once reflected within thoſe drops; but the *Secundary*, by the rays twice reflected, and which after a double refraction in both caſes paſs to the Eye, placed in the *axis* of the Rainbow.

The *Second* Part is diſpatched in *Six* Propoſitions; in which the Author taketh pains, notwithſtanding all what he hath delivered before, to abet *Ariſtotle*'s opinion, importing, that Light is an *Accident*; though he diſſembleth not, that that Philoſopher ſeems to have ſomewhere favour'd the contrary Opinion; as he alſo acknowledgeth, that the Experiments and the Reaſons thence deduced for the *Subſtantiality* of Light, approach very near to a Phyſico-Mathematical evidence, eſpecially with ſuch men as have, either skilfully and carefully made thoſe Experiments, themſelves, or attentively beheld them, when made by others. However, he maketh a ſhift to ſay ſomething by way of Anſwer to all the Arguments, produced in the *firſt* place for the proof of Lights being a Subſtance: yet denying, that, though Light were an Accident, it would follow, that Colours, call'd *Permanent*, are ſomething diſtinct from Light, and reſiding in Bodies when *Light* is abſent.

IV. Marci Meibomii *de Fabrica TRIREMIUM Liber.* Amſtelodami 1671. *in* 4°.

THis Diſcourſe treats *firſt* of the Occaſion and Original of Shipping, and relates, that it began with Oars, and then was improved by Sails, and at laſt was practiſed with the uſe of both.

In the beginning, for Celerity and Fight, they multiplied Oares, and, for ſome ſtrength, they fortifyed their ſhips with ſtrong Beaks, as Birds of pray have ſtrong Wings and a ſharp Beak.

He aſcribes to the *Sidonians* the firſt invention of Building long Ships for War, and the contrivance of filling them with Oares in ſuch a manner, that no void ſpaces might be left. As broader and ſhorter Ships were built for burthen

Gallies he diſtinguiſhes into *Monocrota*, wherein one or more rows of men do ſit in the ſame level or plain; and *Polycrota*, in which the Rowers ſit in divers heights, one above another, as in *Amphi-theaters*; whence the *Biremis*, *Triremis*, *Quadriremis*, and ſo on to the *Teſſaraconteris*, the biggeſt that we read of, and recorded to have been made by *Philopater*.

In the *Monocrota* he conſiders the manner of the Sitting of the Rowers; and the *Interſcalmium*, or the ſpace between the two Oares of the ſame *Verſus* or Row; referring the *Tranſtra* to the *Polycrota Galleys*; where he hath occaſion to examine the meaſure of the great and Roman foot and cubit; as alſo to give the meaning of the words *Verſus* (Gr. ϛοῖχος or ϛίχος) and *Ordo* (Gr. τάξις.)

Next he endeavors to explain in the Galleys that are *Polycrota* of 3, 4, 5, or more tires of Rowers, ſeated in different heights, how thoſe men could be placed. And here he pretends to have been the firſt, that hath perfected the way of leſſening the height of the ancient Galleys, by deviſing theſe two Expedients; by the firſt of which (ſaid to have been publiſhed by him 22 years ſince) he affirms to have ſhewed, ſo to place the Lateral Rowers, as that he that ſits behind an other, may move his hands and Oar *under* the ſeat of the rower ſitting next before him: By which means three lateral Rowers, which, according to *Scaliger*'s way, would require the height of 13½ feet, will be content with the ſpace of 7½ feet. By the *other* Invention, which he *now* adds, he pretends to have found a new place in thoſe Ships for almoſt *half* the number of Rowers; foraſmuch as on the ſide of the aforeſaid Rowers, he placeth others in the middle of the Ship, in *tranſtris* or traverſe Seats, which, as he imagines, (how conſonantly to uſe and practice, the Intelligent ſoon will judge) may thruſt out their Oars under the Seats of the Lateral Rowers. By which contrivance he thinks is gain'd in a *Quinqueremis* the ſpace of nine feet in height: which, he ſaith, *Scaliger*, if alive, would admire. And to all this he ſubjoyns ſome paſſages out of ancient Authors, which he conceives do much ſtrengthen the fitneſs of theſe Inventions of his, concerning both the placing of the Lateral Rowers, and thoſe that ſit in *tranſtris*. Here he inſerts the Explication of thoſe names of *Thalamita*, *Zygita*, and *Thranita*, in the *Triremis*; the firſt ſignifying him that ſits in the loweſt row; the ſecond, him that ſits in *Tranſtris*; the third, him that ſits uppermoſt.

After this, he inquireth, Whether ever ſuch great Veſſels of ſo many tires of Oars, ſitting in ſo many different heights, were ever actually built? And, if they were, Whether they ever came abroad to Fight? Eſpecially ſuch an one as that of *Philopators* is recorded to have been, of forty tires, requiring above four thouſand Rowers; and that of *Ptolemæus Philadelphus*, of thirty tires, having more than three thouſand Rowers; and another of twenty rows, requiring two thouſand. Hereupon our Author ſcruples not to affirm all to be true, what is written of ſuch vaſt Ships; adding, that he hath made it intelligible, how it may be ſo, by finding places for the *Zygitæ*, and a conveniency of moving their Oars under the Seats of thoſe that ſate next before them. And here he ſhews at large, of what determinate bigneſs thoſe Veſſels were, according to his ſuppoſition and contrivance;

vance; beginning from a *Triremis*, and ſhewing, how many Oars and Sea-men it contained, namely two hundred, of which one hundred and eighty were Rowers, and the reſt Marriners. So that in the *Athenian* Fleet, of which *Cono* was General, conſiſting of one hundred and eighty *Triremes*, there were ſix and thirty thouſand Men. Then proceeding to a *Quinque-remis*, with four hundred and twenty Men apiece; of which there were Rowers three hundred, and Souldiers one hundred and twenty. So that three things were ſtupendious in that *Roman* Fleet at *Meſſina*, and the *Carthaginian* at *Lylibeum*; *one* is, that the former conſiſted of three hundred and thirty, and the latter of three hundred and fifty Ships, moſt *Quinqueremes*, that is, an hundred and fifty feet long; the *ſecond*, that the number of Men, they contained, was one hundred and thirty thouſand, and one hundred and fifty thouſand Men; the *third*, the *apparatus* and proviſion neceſſary: Yet all this affirmed by one of the beſt of the ancient Hiſtorians, *Polybius*; who himſelf wonders at ſuch a vaſt Equipage.

Here the Author undertaketh, out of *Polybius*, *Plutarch*, and *Livy*, to refute *Salmaſius*, affirming, that hardly any Galleys were built or equipped bigger than of *Nine Tires*, called ἐννήρης.

Hence he proceeds to the Ships of *Eleven* Rows (ἑνδεκήρης,) and of *Fifteen* Rows (πεντεκαιδεκήρης;) and to one of *Sixteen* (ἑκκαιδεκήρης.)

Having diſpatched theſe particulars (of which we leave Curious and Learned Antiquaries, and good Naval Architects to judge) he propoſeth the *Uſefulneſs* of theſe his Inventions, after that, by the means of them, both the Structure and Ordering of Ancient Shipping hath been explained; and is of opinion, that the *Modern* Galleys and Galleaſſes might, according to his Model, be more conveniently built, both for celerity, ſtrength, and leſſer expences. He thinks, that the Modern form would be better, if in the Structure the proportion of the long Ships of the Antients were obſerved. And he conceiveth alſo, that Five men ſitting at one Oar in the Modern Galeaſſes, much ſtrength is waſted to no purpoſe, becauſe they ſit too near to the ſide or ſtay (the *fulcrum*;) whereas a leſſer number of Rowers, at a greater diſtance from the ſaid Stay, would give more ſtrength for more ſwiftneſs, and require leſs charge.

To which he adds, that theſe Galleys are of great uſe both in Rivers and Un-deep Seas, and therefore convenient for the Baltick and Britannick, as well as the Mediterranean Seas. Further, that they are very ſerviceable for tranſporting great Forces.

Occaſionally (to add that by the by,) he ſhews out of *Joſephus* lib.8.c.7. what is meant by the *Almyggim* Wood in Sacred Writ, 1 *Reg*.10.11, 2 *Chron*. 11. 8, &c. אַלְגֻּמִּים, namely, the Indian *Pine* or *Firr-tree*, brought out of *Ophir*, excellent both for a ſhining Whiteneſs and for Levity; whence very proper for *Muſical* Inſtruments.

LONDON,

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Numb. 80.

PHILOSOPHICAL TRANSACTIONS.

February 19. 16$\frac{71}{72}$.

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SIR,

TO perform my late promiſe to you, I ſhall without further ceremony acquaint you, that in the beginning of the Year 1666 (at which time I applyed my ſelf to the grinding of Optick glaſſes of other figures than *Spherical*,) I procured me a Triangular glaſs-Priſme, to try therewith the celebrated *Phænomena* of

Colours. And in order thereto having darkened my chamber, and made a ſmall hole in my window-ſhuts, to let in a convenient quantity of the Suns light, I placed my Priſme at his entrance, that it might be thereby refracted to the oppoſite wall. It was at firſt a very pleaſing divertiſement, to view the vivid and intenſe colours produced thereby; but after a while applying my ſelf to conſider them more circumſpectly, I became ſurpriſed to ſee them in an *oblong* form; which, according to the received laws of Refraction, I expected ſhould have been *circular*.

They were terminated at the ſides with ſtreight lines, but at the ends, the decay of light was ſo gradual, that it was difficult to determine juſtly, what was their figure; yet they ſeemed *ſemicircular*.

Comparing the length of this coloured *Spectrum* with its breadth, I found it about five times greater; a diſproportion ſo extravagant, that it excited me to a more then ordinary curioſity of examining, from whence it might proceed. I could ſcarce think, that the various *Thickneſs* of the glaſs, or the termination with ſhadow or darkneſs, could have any Influence on light to produce ſuch an effect; yet I thought it not amiſs, firſt to examine thoſe circumſtances, and ſo tryed, what would happen by tranſmitting light through parts of the glaſs of divers thickneſſes, or through holes in the window of divers bigneſſes, or by ſetting the Priſme without ſo, that the light might paſs through it, and be refracted before it was terminated by the hole: But I found none of thoſe circumſtances material The faſhion of the colours was in all theſe caſes the ſame.

Then I ſuſpected, whether by any *unevenneſs* in the glaſs, or other contingent irregularity, theſe colours might be thus dilated. And to try this, I took another Priſme like the former, and ſo placed it, that the light, paſſing through them both, might be refracted contrary ways, and ſo by the latter returned into that courſe, from which the former had diverted it. For, by this means I thought, the *regular* effects of the firſt Priſme would be deſtroyed by the ſecond Priſme, but the *irregular* ones more augmented, by the multiplicity of refractions. The event was, that the light, which by the firſt Priſme was diffuſed into an *oblong* form, was by the ſecond reduced into an *orbicular* one with as much regularity, as when it did not at all paſs through them. So that, what ever was the cauſe of that length, 'twas not any contingent irregularity.

I

I then proceeded to examin more critically, what might be effected by the difference of the incidence of Rays coming from divers parts of the Sun ; and to that end, meaſured the ſeveral lines and angles, belonging to the Image. Its diſtance from the hole or Priſme was 22 foot ; its utmoſt length $13\frac{1}{4}$ inches ; its breadth $2\frac{5}{8}$; the diameter of the hole $\frac{1}{4}$ of an inch ; the angle, with the Rays, tending towards the middle of the image, made with thoſe lines, in which they would have proceeded without refraction, was 44 deg. 56′. And the vertical Angle of the Priſme, 63 deg. 12′. Alſo the Refractions on both ſides the Priſme, that is, of the Incident, and Emergent Rays, were as near, as I could make them, equal, and conſequently about 54 deg. 4′. And the Rays fell perpendicularly upon the wall. Now ſubducting the diameter of the hole from the length and breadth of the Image, there remains 13 Inches the length, and $2\frac{3}{8}$ the breadth, comprehended by thoſe Rays, which paſſed through the center of the ſaid hole, and conſequently the angle of the hole, which that breadth ſubtended, was about 31′, anſwerable to the Suns Diameter ; but the angle, which its length ſubtended, was more then five ſuch diameters, namely 2 deg. 49′.

Having made theſe obſervations, I firſt computed from them the refractive power of that glaſs, and found it meaſured by the *ratio* of the ſines, 20 to 31. And then, by that *ratio*, I computed the Refractions of two Rays flowing from oppoſite parts of the Sun's *diſcus*, ſo as to differ 31′ in their obliquity of Incidence, and found, that the emergent Rays ſhould have comprehended an angle of about 31′, as they did, before they were incident.

But becauſe this computation was founded on the Hypotheſis of the proportionality of the *ſines* of Incidence, and Refraction, which though by my own Experience I could not imagine to be ſo erroneous, as to make that Angle but 31′, which in reality was 2 deg. 49′ ; yet my curioſity cauſed me again to take my Priſme. And having placed it at my window, as before, I obſerved, that by turning it a little about its *axis* to and fro, ſo as to vary its obliquity to the light, more then an angle of 4 or 5 degrees, the Colours were not thereby ſenſibly tranſlated from their place on the wall, and conſequently by that variation of Incidence, the quantity of Refraction was not ſenſibly varied. By this Experiment therefore, as well as by the former computation, it was evident, that the difference of the Incidence of Rays, flowing from divers parts of the Sun, could not make them after decuſſation diverge at a ſenſibly greater angle, than that at which they before converged; which being, at moſt, but about 31 or 32 minutes, there ſtill remained ſome other cauſe to be found out, from whence it could be 2 degr. 49′.

Then I began to ſuſpect, whether the Rays, after their trajection through the Priſme, did not move in curve lines, and according to their more or leſs curvity tend to divers parts of the wall. And it increaſed my ſuſpition, when I remembred that I had often ſeen a Tennis ball, ſtruck with an oblique Racket, deſcribe ſuch a curve line. For, a circular as well as a progreſſive motion being communicated to it by that ſtroak, its parts on that ſide, where the motions conſpire, muſt preſs and beat the contiguous Air more violently than on the other, and there excite a reluctancy and reaction of the Air proportionably greater. And for the ſame reaſon, if the Rays of light ſhould poſſibly be globular bodies, and by their oblique paſſage out of one medium into another acquire a circulating motion, they ought to feel the greater reſiſtance from the ambient Æther, on that ſide, where the motions conſpire, and thence be continually bowed to the other. But notwithſtanding this plauſible ground of ſuſpition, when I came to examine it, I could obſerve no ſuch curvity in them. And beſides (which was enough for my purpoſe) I obſerved, that the difference 'twixt the length of the Image, and diameter of the hole, through which the light was tranſmitted, was proportionable to their diſtance.

The gradual removal of theſe ſuſpitions, at length led me to the *Experimentum Crucis*, which was this: I took two boards, and placed one of them cloſe behind the Priſme at the window, ſo that the light might paſs through a ſmall hole, made in it for the purpoſe, and fall on the other board, which I placed at about 12 feet diſtance, having firſt made a ſmall hole in it alſo, for ſome of that Incident light to paſs through. Then I placed another Priſme behind this ſecond board, ſo that the light, trajected through both the boards, might paſs through that alſo, and be again refracted before it arrived at the wall. This done, I took the firſt Priſme in my hand, and turned it to and fro ſlowly about its *Axis*, ſo much as to make the ſeveral parts of the Image, caſt on the ſecond board, ſucceſſively paſs through the hole in it, that I might obſerve to what places on the wall the ſecond Priſme would refract them.

And I ſaw by the variation of thoſe places, that the light, tending to that end of the Image, towards which the refraction of the firſt Priſme was made, did in the ſecond Priſme ſuffer a Refraction conſiderably greater then the light tending to the other end. And ſo the true cauſe of the length of that Image was detected to be no other, then that *Light* conſiſts of *Rays differently refrangible*, which, without any reſpect to a difference in their incidence, were, according to their degrees of refrangibility, tranſmitted towards divers parts of the wall.

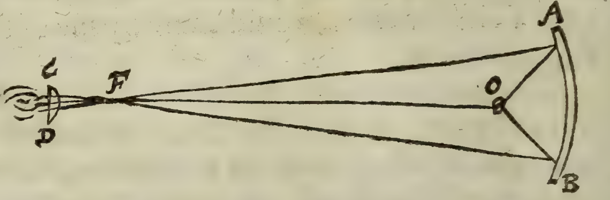
When I underſtood this, I left off my aforeſaid Glaſs works; for I ſaw, that the perfection of Teleſcopes was hitherto limited, not ſo much for want of glaſſes truly figured according to the preſcriptions of Optick Authors, (which all men have hitherto imagined,) as becauſe that Light it ſelf is a *Heterogeneous mixture of differently refrangible Rays*. So that, were a glaſs ſo exactly figured, as to collect any one ſort of rays into one point, it could not collect thoſe alſo into the ſame point, which having the ſame Incidence upon the ſame Medium are apt to ſuffer a different refraction. Nay, I wondered, that ſeeing the difference of refrangibility was ſo great, as I found it, Teleſcopes ſhould arrive to that perfection they are now at. For, meaſuring the refractions in one of my Priſmes, I found, that ſuppoſing the common *ſine* of Incidence upon one of its planes was 44 parts, the *ſine* of refraction of the utmoſt Rays on the red end of the Colours, made out of the glaſs into the Air, would be 68 parts, and the *ſine* of refraction of the utmoſt rays on the other end, 69 parts: So that the difference is about a 24*th* or 25*th* part of the whole refraction. And conſequently, the object-glaſs of any Teleſcope cannot collect all the rays, which come from one point of an object, ſo as to make them convene at its *focus* in leſs room then in a circular ſpace, whoſe diameter is the 50*th* part of the Diameter of its Aperture; which is an irregularity, ſome hundreds of times greater, then a circularly figured *Lens*, of ſo ſmall a ſection as the Object-glaſſes of long Teleſcopes are, would cauſe by the unfitneſs of its figure, were Light *uniform*.

This made me take *Reflections* into conſideration, and finding them regular, ſo that the Angle of Reflection of all ſorts of Rays was equal to their Angle of Incidence; I underſtood, that by their mediation Optick inſtruments might be brought to any degree of perfection imaginable, provided a *Reflecting* ſubſtance could be found, which would poliſh as finely as Glaſs, and *reflect* as much light, as glaſs *tranſmits*, and the art of communicating to it a *Parabolick* figure be alſo attained. But there ſeemed very great difficulties, and I have almoſt thought them inſuperable, when I further conſidered, that every irregularity in a reflecting ſuperficies makes the rays ſtray 5 or 6 times more out of their due courſe, than the like irregularities in a refracting one: So that a much greater curioſity would be here requiſite, than in figuring glaſſes for Refraction.

Amidſt theſe thoughts I was forced from *Cambridge* by the Intervening Plague, and it was more then two years, before I proceeded further. But then having thought on a tender way of poliſhing, proper for metall, whereby, as I imagined, the figure alſo would be corrected to the laſt; I began to try, what might be effected in this kind, and by degrees ſo far perfected an Inſtrument (in the eſſential parts of it like that I ſent to *London,*) by which I could diſcern Jupiters 4 Concomitants, and ſhewed them divers times to two others of my acquaintance. I could alſo diſcern the Moon-like phaſe of *Venus*, but not very diſtinctly, nor without ſome niceneſs in diſpoſing the Inſtrument.

From that time I was interrupted till this laſt Autumn, when I made the other. And as that was ſenſibly better then the firſt (eſpecially for Day-Objects,) ſo I doubt not, but they will be ſtill brought to a much greater perfection by their endeavours, who, as you inform me, are taking care about it at *London*.

I have ſometimes thought to make a *Microſcope*, which in like manner ſhould have, inſtead of an Object-glaſs, a Reflecting piece of metall. And this I hope they will alſo take into conſideration. For thoſe Inſtruments ſeem as capable of improvement as *Teleſcopes*, and perhaps more, becauſe but one reflective piece of metall is requiſite in them, as you may perceive by the annexed diagram, where A B repreſenteth the object metall, C D the eye glaſs, F their common Focus, and O the other focus of the metall, in which the object is placed.



But to return from this digreſſion, I told you, that Light is not ſimilar, or homogeneal, but conſiſts of *difform* Rays, ſome of which are more refrangible than others: So that of thoſe, which are alike incident on the ſame medium, ſome ſhall be more refracted than others, and that not by any virtue of the glaſs, or other external cauſe, but from a prediſpoſition, which every particular Ray hath to ſuffer a particular degree of Refraction.

I ſhall now proceed to acquaint you with another more notable difformity in its Rays, wherein the *Origin of Colours* is unfolded: Concerning which I ſhall lay down the *Doctrine* firſt, and then, for its examination, give you an inſtance or two of the *Experiments*, as a ſpecimen of the reſt.

The Doctrine you will find comprehended and illuſtrated in the following propoſitions.

1. As the Rays of light differ in degrees of Refrangibility, ſo they alſo differ in their diſpoſition to exhibit this or that particular colour. Colours are not *Qualifications of Light*, derived from Refractions, or Reflections of natural Bodies (as 'tis generally believed,) but *Original* and *connate properties*, which in divers Rays are divers. Some Rays are diſpoſed to exhibit a red colour and no other; ſome a yellow and no other, ſome a green and no other, and ſo of the reſt. Nor are there only Rays proper and particular to the more eminent colours, but even to all their intermediate gradations.

2. To the ſame degree of Refrangibility ever belongs the ſame colour, and to the ſame colour ever belongs the ſame degree of Refrangibility. The *leaſt Refrangible* Rays are all diſpoſed to exhibit a *Red* colour, and contrarily thoſe Rays, which are diſpoſed to exhibit a *Red* colour, are all the leaſt refrangible: So the *moſt refrangible* Rays are all diſpoſed to exhibit a deep *Violet-Colour*, and contrarily thoſe which are apt to exhibit ſuch a violet colour, are all the moſt Refrangible. And ſo to all the intermediate colours in a continued ſeries belong intermediate degrees of refrangibility. And this Analogy 'twixt colours, and refrangibility, is very preciſe and ſtrict; the Rays always either exactly agreeing in both, or proportionally diſagreeing in both.

3. The ſpecies of colour, and degree of Refrangibility proper to any particular ſort of Rays, is not mutable by Refraction, nor by Reflection from natural bodies, nor by any other cauſe, that I could yet obſerve. When any one ſort of Rays hath been well

parted from thoſe of other kinds, it hath afterwards obſtinately retained its colour, notwithſtanding my utmoſt endeavours to change it. I have refracted it with Priſmes, and reflected it with Bodies, which in Day-light were of other colours; I have intercepted it with the coloured film of Air interceding two compreſſed plates of glaſs; tranſmitted it through coloured Mediums, and through Mediums irradiated with other ſorts of Rays, and diverſly terminated it; and yet could never produce any new colour out of it. It would by contracting or dilating become more brisk, or faint, and by the loſs of many Rays, in ſome caſes very obſcure and dark; but I could never ſee it changed *in ſpecie*.

Yet ſeeming tranſmutations of Colours may be made, where there is any mixture of divers ſorts of Rays. For in ſuch mixtures, the component colours appear not, but, by their mutual allaying each other, conſtitute a midling colour. And therefore, if by refraction, or any other of the aforeſaid cauſes, the difform Rays, latent in ſuch a mixture, be ſeparated, there ſhall emerge colours different from the colour of the compoſition. Which colours are not New generated, but only made Apparent by being parted; for if they be again intirely mix't and blended together, they will again compoſe that colour, which they did before ſeparation. And for the ſame reaſon, Tranſmutations made by the convening of divers colours are not real; for when the difform Rays are again ſevered, they will exhibit the very ſame colours, which they did before they entered the compoſition; as you ſee, *Blew* and *Yellow* powders, when finely mixed, appear to the naked eye *Green*, and yet the Colours of the Component corpuſcles are not thereby really tranſmuted, but only blended. For, when viewed with a good Microſcope, they ſtill appear *Blew* and *Yellow* interſperſedly.

5. There are therefore two ſorts of Colours. The one original and ſimple, the other compounded of theſe. The Original or primary colours are, *Red*, *Yellow*, *Green*, *Blew*, and a *Violet-purple*, together with Orange, Indico, and an indefinite variety of Intermediate gradations.

6. The ſame colours in *Specie* with theſe Primary ones may be alſo produced by compoſition: For, a mixture of *Yellow* and *Blew* makes *Green*; of *Red* and *Yellow* makes *Orange*; of *Orange* and *Yellowiſh green* makes *yellow*. And in general, if any two Colours be mixed, which in the ſeries of thoſe, generated by the Priſme, are

not too far diſtant one from another, they by their mutual alloy compound that colour, which in the ſaid ſeries appeareth in the mid-way between them. But thoſe, which are ſituated at too great a diſtance, do not ſo. *Orange* and *Indico* produce not the intermediate Green, nor Scarlet and Green the intermediate yellow.

7. But the moſt ſurpriſing, and wonderful compoſition was that of *Whiteneſs*. There is no one ſort of Rays which alone can exhibit this. 'Tis ever compounded, and to its compoſition are requiſite all the aforeſaid primary Colours, mixed in a due proportion. I have often with Admiration beheld, that all the Colours of the Priſme being made to converge, and thereby to be again mixed as they were in the light before it was Incident upon the Priſme, reproduced light, intirely and perfectly white, and not at all ſenſibly differing from a *direct* Light of the Sun, unleſs when the glaſſes, I uſed, were not ſufficiently clear; for then they would a little incline it to *their* colour.

8. Hence therefore it comes to paſs, that *Whiteneſs* is the uſual colour of *Light*; for, Light is a confuſed aggregate of Rays indued with all ſorts of Colors, as they are promiſcuouſly darted from the various parts of luminous bodies. And of ſuch a confuſed aggregate, as I ſaid, is generated Whiteneſs, if there be a due proportion of the Ingredients; but if any one predominate, the Light muſt incline to that colour; as it happens in the Blew flame of Brimſtone; the yellow flame of a Candle; and the various colours of the Fixed ſtars.

9. Theſe things conſidered, the *manner*, how colours are produced by the Priſme, is evident. For, of the Rays, conſtituting the incident light, ſince thoſe which differ in Colour proportionally differ in Refrangibility, *they* by their unequall refractions muſt be ſevered and diſperſed into an oblong form in an orderly ſucceſſion from the leaſt refracted Scarlet to the moſt refracted Violet. And for the ſame reaſon it is, that objects, when looked upon through a Priſme, appear coloured. For, the difform Rays, by their unequal Refractions, are made to diverge towards ſeveral parts of the *Retina*, and there expreſs the Images of things coloured, as in the former caſe they did the Suns Image upon a wall. And by this inequality of refractions they become not only coloured, but alſo very confuſed and indiſtinct

10. Why the Colours of the *Rainbow* appear in falling drops

of Rain, is alſo from hence evident. For, thoſe drops, which refract the Rays, diſpoſed to appear purple, in greateſt quantity to the Spectators eye, refract the Rays of other ſorts ſo much leſs, as to make them paſs beſide it; and ſuch are the drops on the inſide of the *Primary* Bow, and on the outſide of the *Secondary* or Exteriour one. So thoſe drops, which refract in greateſt plenty the Rays, apt to appear red, toward the Spectators eye, refract thoſe of other ſorts ſo much more, as to make them paſs beſide it; and ſuch are the drops on the exteriour part of the *Primary*, and interiour part of the *Secondary* Bow.

11. The odd Phænomena of an infuſion of *Lignum Nephriticum*, *Leaf gold*, *Fragments of coloured glaſs*, and ſome other tranſparently coloured bodies, appearing in one poſition of one colour, and of another in another, are on theſe grounds no longer riddles. For, thoſe are ſubſtances apt to reflect one ſort of light and tranſmit another; as may be ſeen in a dark room, by illuminating them with ſimilar or uncompounded light. For, then they appear of that colour only, with which they are illuminated, but yet in one poſition more vivid and luminous than in another, accordingly as they are diſpoſed more or leſs to reflect or tranſmit the incident colour.

12. From hence alſo is manifeſt the reaſon of an unexpected Experiment, which Mr. *Hook* ſomewhere in his *Micrography* relates to have made with two wedg-like tranſparent veſſels, fill'd the one with a red, the other with a blew liquor: namely, that though they were ſeverally tranſparent enough, yet both together became opake; For, if one tranſmitted only red, and the other only blew, no rays could paſs through both.

13. I might add more inſtances of this nature, but I ſhall conclude with this general one, that the Colours of all natural Bodies have no other origin than this, that they are variouſly qualified to reflect one ſort of light in greater plenty then another. And this I have experimented in a dark Room by illuminating thoſe bodies with uncompounded light of divers colours. For by that means any body may be made to appear of any colour. They have there no appropriate colour, but ever appear of the colour of the light caſt upon them, but yet with this difference, that they are moſt brisk and vivid in the light of their own day-light-colour. *Minium* appeareth there of any colour indifferently, with which 'tis illuſtrated, but yet moſt luminous in red, and ſo

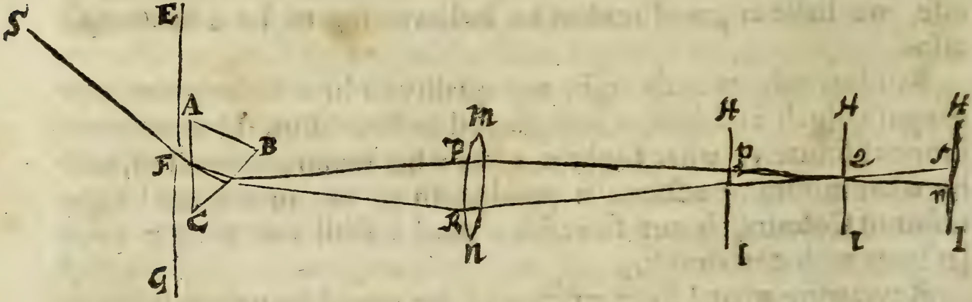
Biſe appeareth indifferently of any colour with which 'tis illuſtrated, but yet moſt luminous in blew. And therefore *Minium* reflecteth Rays of any colour, but moſt copiouſly thoſe indued with red; and conſequently when illuſtrated with day-light, that is, with all ſorts of Rays promiſcuouſly blended, thoſe qualified with red ſhall abound moſt in the reflected light, and by their prevalence cauſe it to appear of that colour. And for the ſame reaſon *Biſe*, reflecting blew moſt copiouſly, ſhall appear blew by the exceſs of thoſe Rays in its reflected light; and the like of other bodies. And that this is the intire and adequate cauſe of their colours, is manifeſt, becauſe they have no power to change or alter the colours of any ſort of Rays incident apart, but put on all colours indifferently, with which they are inlightned.

Theſe things being ſo, it can be no longer diſputed, whether there be colours in the dark, nor whether they be the qualities of the objects we ſee, no nor perhaps, whether Light be a Body. For, ſince Colours are the *qualities* of Light, having its Rays for their intire and immediate ſubject, how can we think thoſe Rays *qualities* alſo, unleſs one quality may be the ſubject of and ſuſtain another; which in effect is to call it *Subſtance*. We ſhould not know Bodies for ſubſtances, were it not for their ſenſible qualities, and the Principal of thoſe being now found due to ſomething elſe, we have as good reaſon to believe that to be a Subſtance alſo.

Beſides, whoever thought any quality to be a *heterogeneous* aggregate, ſuch as Light is diſcovered to be. But, to determine more abſolutely, what Light is, after what manner refracted, and by what modes or actions it produceth in our minds the Phantaſms of Colours, is not ſo eaſie. And I ſhall not mingle conjectures with certainties.

Reviewing what I have written, I ſee the diſcourſe it ſelf will lead to divers Experiments ſufficient for its examination: And therefore I ſhall not trouble you further, than to deſcribe one of thoſe, which I have already inſinuated.

In a darkened Room make a hole in the ſhut of a window, whoſe diameter may conveniently be about a third part of an inch, to admit a convenient quantity of the Suns light: And there place a clear and colourleſs Priſme, to refract the entring light towards the further part of the Room, which, as I ſaid, will thereby be diffuſed into an oblong coloured Image. Then place a *Lens* of about three foot radius (ſuppoſe a broad Object-glaſs of a three foot Teleſcope,) at the diſtance of about four or five foot from thence, through which all thoſe colours may at once be tranſmitted, and made by its Refraction to convene at a further diſtance of about ten or twelve feet. If at that diſtance you intercept this light with a ſheet of white paper, you will ſee the colours converted into whiteneſs again by being mingled. But it is requiſite, that the *Priſme* and *Lens* be placed ſteddy, and that the paper, on which the colours are caſt, be moved to and fro; for, by ſuch motion, you will not only find, at what diſtance the whiteneſs is moſt perfect, but alſo ſee, how the colours gradually convene, and vaniſh into whiteneſs, and afterwards having croſſed one another in that place where they compound Whiteneſs, are again diſſipated, and ſevered, and in an inverted order retain the ſame colours, which they had before they entered the compoſition. You may alſo ſee, that, if any of the Colours at the *Lens* be intercepted, the Whiteneſs will be changed into the other colours. And therefore, that the compoſition of whiteneſs be perfect, care muſt be taken, that none of the colours fall beſides the *Lens*.



In the annexed deſign of this Experiment, A B C expreſſeth the Priſm ſet endwiſe to ſight, cloſe by the hole F of the window E G. Its vertical Angle A C B may conveniently be about 60 degrees: *M N* deſigneth the *Lens*. Its breadth $2\frac{1}{2}$ or 3 inches. S F one of the ſtreight lines, in which difform Rays may be conceived to flow ſucceſſively from the Sun. F P, and F R two of thoſe Rays unequally refracted, which the *Lens* makes to converge towards Q, and after decuſſation to diverge again. And H I the paper, at divers diſtances, on which the colours are projected: which in Q conſtitute *Whiteneſs*, but are *Red* and *Yellow* in R, r, and ρ, and *Blew* and *Purple* in P, p, and π.

If you proceed further to try the impoſſibility of changing any uncompounded colour (which I have aſſerted in the third and thirteenth Propoſitions,) 'tis requiſite that the Room be made very dark, leaſt any ſcattering light,mixing with the colour,diſturb and allay it, and render it compound, contrary to the deſign of the Experiment. 'Tis alſo requiſite, that there be a perfecter ſeparation of the Colours, than,after the manner above deſcribed, can be made by the Refraction of one ſingle Priſme, and how to make ſuch further ſeparations,will ſcarce be difficult to them,that conſider the diſcovered laws of Refractions. But if tryal ſhall be made with colours not throughly ſeparated, there muſt be allowed changes proportionable to the mixture. Thus if compound Yellow light fall upon Blew *Biſe*, the Biſe will not appear perfectly yellow, but rather green, becauſe there are in the yellow mixture many rays indued with green, and Green being leſs remote from the uſual blew colour of Biſe than yellow, is the more copiouſly reflected by it.

In like manner, if any one of the Priſmatick colours, ſuppoſe Red, be intercepted, on deſign to try the aſſerted impoſſibility of reproducing that Colour out of the others which are pretermitted ; 'tis neceſſary,either that the colours be very well parted before the red be intercepted, or that together with the red the neighbouring colours, into which any red is ſecretly diſperſed, (that is, the yellow, and perhaps green too) be intercepted, or elſe, that allowance be made for the emerging of ſo much red out of the yellow green, as may poſſibly have been diffuſed, and ſcatteringly blended in thoſe colours. And if theſe things be obſerved, the new Production of Red, or any intercepted colour will be found impoſſible.

This,I conceive, is enough for an Introduction to Experiments of this kind ; which if any of the *R.Society* ſhall be ſo curious as to proſecute,I ſhould be very glad to be informed with what ſucceſs: That,if any thing ſeem to be defective,or to thwart this relation, I may have an opportunity of giving further direction about it, or of acknowledging my errors, if I have committed any.

So far this Learned and very Ingenious Letter ; which having been by that *Illuſtrious Company*, before whom it was read, with much applauſe committed to the conſideration of ſome of their Fellows,well verſed in this argument, the Reader may poſſibly in an other *Tract* be informed of ſome report given in upon this Diſcourſe.

An Accompt of ſome Books.

I. *Beſchriving der OOST-INDISCHE KUSTEN, MALABAR COROMANDEL, CEYLON, &c.* *Door* Philippus Baldæus. *T'* Amſterdam 1672. *in Fol.*

THe Author of this recent Hiſtory, an active Dutch Miniſter, having lived many years in the *Eaſt-Indies*, eſpecially in *Ceylon*, hath taken great pains to give an account not only of the late Civil Tranſactions of his Country-men and others in thoſe parts (of moſt of which he hath been an Ey-witneſs;) but alſo of many of the Obſervables in *Natural* and *Moral* things in the ſame Countries.

Being mindful of what belongs to our deſign in theſe Tracts, we ſhall but tranſiently touch, that in this Deſcription are contained the Negotiations, Treatiſes, and ways of Trade of the Dutch there, both with the *Indians* and *Europeans*; together with many relations of what hath of late paſſed there, between the *Dutch*, *Engliſh*, *Portugueſes*, *Mores*, *&c.* and of the acqueſts, which the Hollanders have there made in Lands, Towns and Strong places; all which, and many others, are here repreſented in very fair *Cuts*; ſuch as are the Maps of the *Coaſts of Malabar* and *Coromandel*, and of the Iſland of *Ceylon*; and the particular Cuts of *Amadavat*, *Zuratte*, *Bombaja*, *Goa*, *Cranganor*, *Couchin*, *Coulang*, *Tutecorin*, *Negnapatan*, *Paliacatta*, *Maſulipatan*, and the repreſentations of the principal Forts of *Ceylon*, as *Batecalo*, *Gale*, *Columbo* (the long and difficult ſiege whereof, together with its being taken by the Dutch from the *Portugueſes* is here very largely deſcribed,) *Negumbo*, *Manaar* (a ſmall Iſle belonging to *Ceylon*) as alſo that conſiderable pen-inſule, *Jaſnapatnam*, lying within the ſame *Ceylon*; and may other leſs conſiderable places.

But, to come to the *Natural* Obſervations, our Author taketh notice of the following particulars; ſcattered up and down in this Volume.

1. That in the Haven of *Suratte*, (being about 22 deg. Northern lat.) a Nord-Nord-Eaſt and a South-Weſt Moon makes the higheſt water; *p.*12.

2. That the Elephants, made to fight with one another before the *G.Mogol*, manage the combat with a far greater agility and courag

courage than one would imagine, and that they preſently fall on, and deſiſt according to the word given, embracing one another moſt lovingly with their truncks, as ſoon as they are commanded to end the combat; *p.*21.

3. That at *Goa*, lying in 16 deg. Northern Latitude upon an Iſle, the Climat is very unwholeſome, and ſubject to great mortality; though a place ſcituate for great Trade, which it manages with *Pegu, Siam, Japan, Perſia, Cambaja, Arabia, Malabar, Coromandel, Bengala, Achem,* &c. *p.*79.

4. That on the Coaſt of *Malabar* the nights are very cold, and that there falls a great dew, eſpecially in the months of *January, Febr.* and *March*, which is followed by intolerable heats in the day; as alſo, that the Land-briſes begin in the morning about 9 and 10 a clock, and the Sea-briſes ſoon after Sun-ſetting. The Productions of that Country are chiefly *Pepper*, (which is of three ſorts, black, whitiſh, and long,) *Aloe, Cardemom, Ginger,* ſome *Saltpeter* and *Gumme-lack*; as alſo *Bezoar-ſtones*, which are beſt at *Cananor*; likewiſe *Mirabolans, Tamarines*: That Pepper grows beſt in ſhadowy places; hath a weak ſtem, to be ſupported like Vines; having on each branch commonly ſix cluſters, each a foot long, in colour like unripe grapes; that they gather it, being green, in *October* and *November*, expoſing it to the Sun to dry, whereby it grows black in a few days; *p.*99. 100, 101.

5. That at *Cananor* there are ſometimes found *Bezoar-ſtones*, of the bigneſs not only of a Pigeons-Egg, (which may be had for ſix or ſeven reals,) but alſo of that of a Hens-egg, for 12 reals a piece; *p.* 100.

6. That the way, there uſed, to diſcern a true *Bezoar* from a falſe one, is, *either* by preſſing upon it a red-hot iron-bodkin, whence it will receive no harm, if genuine; *or* by weighing it, and then letting it lye in water a whole night; whereupon, if it keep its former weight 'tis a true one; if not, 'tis counterfait; *ibid.*

7. That at *Cochin*, the Capital of one of the Kingdoms of *Malabar*, the Tempeſtuous winds, there reigning in the winter-months, drive together abundance of clouds againſt the mountains, where having hung a while, they fall down at laſt with a ſudden impetuoſity in dreadful ſhowers, carrying along with them ſtore of earth and ſands into the Sea, which are by the ſame, with certain winds, driven back again, and do obſtruct the mouth of the River of that place; which yet is diſ-obſtructed again in the Sommer-ſeaſon; *p.*115.

8. That moſt of the Inhabitants of *Porca* in the Country of *Malabar* have ſwollen Legs; aſcribed to the brackiſh and Salt-petry water, they muſt drink there; *p.* 143.

9. That the *Nairos*, (the Gentry of *Malabar*, and the Military men there) are from their youth, even from the ſeventh year of their age, diſciplin'd to great agility of Body, by ſtretching their tender ſinews, and anointing them with certain oyls and unguents, whereby they are diſpoſed to wind and turn their body with extraordinary nimbleneſs any way, and to wreſtle to admiration; *p.* 144, 145.

10. That about *Tutecoryn*, in *Malabar*, is one of the three chief Pearl-fiſhings in the Eaſt-Indies, comprizing ***Manaar*** and ***Aripou***, ſcituate between ***Comorin*** and ***Ceilon***; the other two places for taking that rich commodity being ***Ormus*** in ***Perſia***, and ***Ainam*** on the coaſt of ***China***. Further, that the Pearl-bearing Oyſters are hard and tough, and not good to eat: *That* they muſt be dived for, 7, 8, 9, 10, fathoms deep; *that* all years do not equally yield Pearls, in regard that ſometimes the Pearl-banks are cover'd with ſand, and ſometimes the Oyſters are too ſmall; *that* the Pearls of *Tutecoryn* and *Manaar* are inferior in goodneſs to thoſe of ***Ormus***, thoſe being neither ſo white nor bright as theſe; *p.* 151.

11. That at *Tutecoryn*, lying near *Comoryn*, there is a quite different ſeaſon from the places ſcituate cloſe to the North of that *Cape*; ſince, whereas from *April* to *September* it is Summer on the South of that *Cape*, 'tis then Winter on the North of the ſame, there blowing then ſtrong winds on the one ſide of thoſe mountains, and none on the other. The like of which is found upon ſeveral other coaſts of the *Indies*, as alſo in ſome places of *Africa*; *p.* 152.

12. That the beſt ſtained clothes are made about *Maliapour*, to which a peculiar kind of water, ſpringing there, is thought to be very conducive; *p.* 159.

13. That between ***Penna*** and ***Caleture***, North of ***Palecatta***, on the coaſt of *Coromandel*, there grows the beſt *Eſſaye*; which is a ſmall root, uſed in ſtaining Indian Clothes with fixt colours. And that, to diſcern the beſt of the kind, it muſt be broken, and obſerved, whether it be of a deep red; beſides, it is to be chaw'd, and, if found of a Nitrous taſte, 'tis eſteemed good. And to examine the ſincerity of that colour, when the cloth is already ſtained with it, they rub it hard with the Juice of Limon, and ſo let it dry

in

2.*Phil. Baldæus* his Deſcription of ſome of the chief parts of the Eaſt-Indies, n. 80.

3.*Iſaac Barrow* S.R. Lectiones 18. in quibus Opticorum *Phænomenûm* genuinæ rationes inveſtigantur, 75.2278.

4.Ejuſdem *Lectiones* 13. Geometricæ, in quibus generalia Linearum Curvarum ſymptomata declarantur, *ibid.*

5.*Joh. Joach. Beckeri* Experimentum Chymicum, artificialem & ſubitam Metallorum generationem & tranſmutationem ad oculum demonſtrans, 74. 2232. with a brief touch on his Phyſica Sub-terranea, *ibid.*

6.M. *Bernier* on the Empire of the G. *Mogol* rendred Engliſh, 75.2263.

7.*Joh. Alph. Borellus* de motionibus à Gravitate dependentibus, 73.2210

8.Ejuſdem Hiſtoria & Meteorologia Incendii Ætnæi A.1669. n. 75.2264.

9.M. *Bourdelot* his reſearches and Obſervations upon Vipers, 77.3013.

10.Mr. *Boyle* of the Uſefulneſs of Experimental Philoſophy Tom. 2. n. 72.2179

11. *P. Cherubim d'Orleans* la Dioptrique Oculaire, 78.3045.

12.*Diophanti Alex.* Arithmeticorum libri 6. cum Comment. Bacheti & Obſervationibus Fermati; cui acceſſit Doctrinæ Analyticæ Inventum Novum, 72.2185.

13. *Mich. Febr.* M.D. de Abſynthii natura, 74.2235.

14 *Car.* de la *Font* diſſertat. duæ de Veneno Peſtilentiali 73.2210.

15. *Theoph. Gale* his Original of Humane Literature, both Philology and Philoſophy, 74.2231.

16. *Regn. de Graef* de Succo Pancreatico, & de Genitalibus Mulierum, 79.3066.

17. *Ant.* le *Grand* Philoſophia Veterum è mente Renati Des-Cartes breviter digeſta, 70.2138.

18.Ejuſdem Inſtitutio Philoſophiæ, n. 80.

19.*Neh. Grew* S.R. The Anatome of Vegetables begun; with a general accompt of Vegetation grounded thereon, 78.3037.

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22.*Th. Hobbs* Roſetum Geometricum, 72, 2185.

23. The ſame refuted by Dr. *Wallis* S.R. 73.2202.

24. *Theod. Kerkringii* Anthropogeniæ Ichnographia, 70.2136.

25. Idem in Currum Triumphalem Antimonii *Baſ. Valentini*, 71.2162.

26. *Frid. Lachmundi* Deſcriptio admirabilium Foſſilium, quæ in Tractu *Hildeſheimenſi* reperiuntur, 77 3016.

27. *Fr.* de *Lana* Prodromo de alcuni inventioni nuove, premiſſe al Arte Maeſtra, 69.2114.

28. *Leibnitii* Hypotheſis Phyſica Nova, ſive Theoria de motu Concreto, unà cum Theoria Motûs Abſtracti: and Dr. *Wallis's* Opinion concerning it, 74.2227.

29. *Rich. Lower* S.R. de Corde, & de Motu, & Calore Sanguinis, & Chyli in eum tranſitu: unà cum Diſſertatione de Origine Catarrhi, 73.2211.

30.*Dan. Ludovici* Pharmacia moderno ſeculo applicanda, 76.2287.

31.*Joh. Henr. Meibomius* de Cereviſiis potibuſque & Ebriaminibus, &c. Cui additur de Vino Uvæ & Pomorum 69.2116.

32.*Meibom.* de Fabrica Triremium, 79. 3071.

33. *H. Mori* Enchiridion Metaphyſicum, ſive de rebus Incorporeis Diſſertatio, 72. 2182.

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36.*Ignace Gaſton Pardies* Elemens de Geometrie, 79.3064.

37.*Sim. Pauli* Botanicum, 76.2291.

38.M. *Petit*, Obſervations ſur la nature du Froid & du Chaud; avec un Diſcours ſur la conſtruction & l'uſage d'un Cylindre Arithmetique, 78.3043.

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47. *Matth. Tillingius* de Laudano Opiato, 74.2237.

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49. Notice of *Vitruvius*, to be rendred Engliſh, with the choiceſt modern notes, and diagrams. 72.2190.

50.*Joh. Walliſii* R.S. de Motu Pars 3a. 76. 2286.

51.*Goth.*

51.*Goth.Voigtii* Deliciæ Phyſicæ,77.3017.

52.*Nic.Witſen* of Naval Architecture and Conduct,77.3006.

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Note.

A corrupt *Tranſlation* of theſe *Phil. Tranſactions* into *Latin*, animadverted upon,75.2269.

ERRATA in *Number* 79.*Page* 3054.*l.*18. r.*are not wanting*.ibid.*l.*19. r.*And in theſe*.

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in the Sun; whereupon the red colour will appear faded, if falſe.

14. That at *Petapouli*, near *Maſulipatan*, on the ſame Coaſt, there grows another excellent *Eſſaye*, call'd *Tambrevelle*, yielding ſo high and intenſe a colour, that it muſt be mixed with the *Eſſaye* of *Arrical* or *Ortacour*, to qualifie its intenſneſs. This is only in the power of the Governour of that place.

15. That the great Trafick in Diamonds and Rubies is at *Maſulipatan*; that Diamonds are digg'd in the Countries of *Golconda* and *Decan*, behind *Bengala*, near the Town *Byſilaga*; the Prince whereof keeps a continual guard there, reſerving for himſelf all ſuch Stones as way above 25 *Mangely's* or Carats. The *Old Rock* is in the Country of *Deyam*, yielding the beſt Diamonds of all. *Borneo* likewiſe is famous for theſe Stones, and eſpecially the Town *Bangar Maſſing*.

Here the Author ſpends a whole Chapter in diſcourſing of all ſorts of *Gems*, and the variety of each kind; together with the places of their growth, and the ſeveral ways of examining their goodneſs, and the meaſure of valuing them. *See Chap.* 24. *p.*162.

16. That the Plant, which yields the *Indigo*, beareth a flower like that of *Thiſtles*, and a Seed like that of *Fænum Græcum*: That being firſt Sown, it holds out 3 years; the *firſt* year 'tis cut one foot high from the ground, and the leaves, ſtript from the ſtalks, are expoſed to dry in the Sun for a day, and then for 4 or 5 days kept in round Tanks or Ciſterns, filled with fair water, but brackiſh, with ſtones laid on them, and ſometimes ſtirring the water. This water is let out into another Ciſtern, and there left a whole night; after which, two men, ſtanding in the Tank, muſt labour with the arms, as if they were churning of Butter, till the water thickens; the ſubſtance of the *Indigo* being fallen to the bottom: which is then taken out, and being ſearſed through a fine Cloth, is thinly ſpread and laid in the Sun to dry; which maketh the fine *Indigo*. The *ſecond* year, it grows up and is cut again, being, at leaſt, as good as the *Gyngy* or wild *Indigo*; And, if you will have the Seed of *Indigo*, the ſtalks of it muſt be left to dry this time in the field, and then cut, and the Seed gathered. The *third* year, it is commonly of little force, and is uſed by the ſole *Natives* for coloration; no Strangers caring for it: *p.*170.

17. That the principal marks of good *Indigo* are, dryneſs, lightneſs, and ſwimming on water, yielding a high Violet-colour, and when put upon live coals, giving a Violet ſmoak, and leaving but

few aſhes. That the *Indigo*-Merchant is to beware of buying moiſt *Indigo*, becauſe he will then find, that in eight days time he looſes 3 pound in 10; that the ſame is to try it in a cleer Sun-ſhine, by breaking ſome lumps in pieces, and viewing them well, whether he can obſerve any thing in them that gliſtens; which if he does, he may be ſure, that there is ſand in it, with which it hath been ſophiſticated, to increaſe and gain by the weight. But for the greater aſſurance of the goodneſs of *Indigo*, paſs the nail of your thumb over the broken pieces, and it will be of a Violet-colour, if it be good, and the higher that colour, the better the *Indigo*; *p*.172.

18. That the beſt *Indigo* falls about *Ayra*, *Fettapour*, *Baſſaune*, *Kindawen*, but eſpecially at *Byana*; all places in the *G.Mogols* Dominions: *Ibid.*

19. That *Thea* is by the people of *China* eſteem'd wholeſomeſt when taken faſting,and without Sugar;*that* the *Dutch* uſe it much in *India* for health and chearfulneſs; *that* 'tis very diuretical, and opening the kidneys, and cauſing free reſpiration; *that* the beſt grows in the province of *Kiangnan* in *China*, about the Town *Hoci-cheu*; *that*,when good, the Leaves yield a very pleaſing ſcent; *that* 'tis a *Virgultum*, and its leaves very like that, which is called *Rhus Coriaria*, or *Sumach*; *that* the *Thea* of *China* far excels that of *Japan*; *p*.182.

20. The regiment of Life obſerv'd by diſcreet *Hollanders* in the *Eaſt-Indies*; *ibid.*

21. A Deſcription of the *Ganges* and *Nile*; *ib.*

22. An ample Deſcription of the Iſland of *Ceylon*; *p*. 1. of the *ſecond* part of this Volume. Its riches in ſeveral precious Stones, in *Elephants*, and principally in *Cinnamon* and *Cardamom*; *ibid.*

23. That the *Dutch*, upon their Maſtering the *Portugueſes* in *Ceylon* and *Manaar*, have reſtored the Pearl-fiſhing there, which had been a good while interrupted by the Wars between theſe Nations in thoſe parts; *p*.150.

24. That the Coaſt of *Manaar* is rich in *Fiſh*; among which there are ſtore of *Caymans*, and a kind of *Sea-Calf*, which is Amphibious, and yields Meat, not only far excelling that of *Sturgeon*, but alſo taſting like *Veal*; and that the Females of them have Milk in their Duggs; *p*. 152.

25. That, when in the Pen-inſule of *Jafnapatnam* (a part of *Ceylon*,) and in the Iſle of *Manaar* 'tis Winter and Rainy, 'tis at the

ſame time Summer in the reſt of *Ceylon*, and on the contrary; *that* in the Plains of *Ceylon* there never blow but two ſorts of *Wind*, North and South; but *that* about the higher parts of *Columbo* and *Gale*, &c. the Land-winds reign in the night, and the Sea-winds in the day-time; *p*. 153.

26. That in *Patiarapalli*, one of the Provinces of *Jafnapatnam*, the *Elephants* by the ſtrength of their Body bear down every year abundance of wild Palm-trees, when their fruit is ripe; *p*. 170.

27. That in *Paletiva*, one of the ſmall Iſles near *Jafnapatnam*, the people catch the wild Horſes there by chaſing them into a Water-pool, and ſo maſtering them with nooſes: *p*. 172.

28. That the Wild *Elephants* are by the tame Females of the ſame kind as 'twere duckoy'd into a lodge with trap-doors, where by hunger, and long wakes, and the diſcipline exerciſed upon them by tame *Elephants*, they are at length tamed themſelves.

29. That *Ceylon* abounds, beſides *Elephants* and *Wild Horſes*, with *Buffalo's*, *Oxen*, *Cows*, *Sheep*, *Hoggs*, *Goats*, *Dear*, *Elks*, *Wild Bores*, *Tygers*, *Bears*, *Jackals*, *Apes*, *Peacocks*, *Nightingales*, *Larks*, *Snipes*, *Partridges*, *Pigeons*, *Geeſe*, *Crows*, *Kites*, *Owls*, &c. Of the *Jackals* this Author ſaith, that they are ſo greedy after Mans fleſh, that the Inhabitants are fain to keep their Dead from them by covering their Sepulchres with large ſtones. To which he adds, that their Fleſh is very medicinal for a Conſumption; *p*. 198, 199.

30. That there are *Serpents* in *Ceylon*, which they call *Sea-Serpents*, 8, 9, or 10 Ells long; (I ſuppoſe he ſpeaks of *Dutch* meaſure:) And others, that catch *Mice* and *Rats*, and do no hurt to Mankind: As alſo another ſort, called *Cobres Capellos*, the moſt venomous of all, whoſe bite is ſaid to be commonly cured by the Stone found in the head of the ſame Creature, laid upon the wound and purged in Milk.

31. That *Ceylon* affords divers ſorts of *Precious Stones*, as *Rubies*, *Saphirs*, *Topaſſes*, *Granats*; and Mines alſo of *Gold*, *Silver*, and *Iron*, but that the Kings of the Iſland will not ſuffer the Royal Mettals to be digged up.

32. That the Commodities for Trade in *Ceylon*, are, *Stained Stuffs*, *silks*, *Porcelain*, *Spices*, *Camphire*, *Amber-gris*, *Radix Chinæ*, *Amphion*, *Muſcus*, *Santal*, *Saltpeter*, *Sulphur*, *Lead*, *Copper*, *Tin*, &c.

So much for the Philoſophical part of this Work: What concerns the particulars, relating to the proceedings of the *Dutch* in the *Eaſt-Indies*, as to their Trade there, and the Acquiſitions they have there made among the Natives, *Portugueſes*,&c ; as alſo what belongs to the Morals and the odd Religions of thoſe Indian Heathens, I muſt refer the Reader to the Book it ſelf.

II. Antonii le Grand *INSTITUTIO PHILOSOPHIÆ, ſecundum Principia* Renati Des-Cartes ; *nova methodo adornata & explicata.* Londini, *apud* J. Martyn, *in Cæmeterio D.* Pauli, 1672. *in* 8°.

This Author hath with much induſtry and clearneſs laid together, in this ſmall pocket-volume, all the parts of the *Carteſian* Philoſophy, to facilitate the ſtudy of the ſame to ſuch as deſire to inſtruct themſelves in it.

He begins with the Art of uſing Reaſon aright, and inſiſts much upon this, that we are to deveſt our ſelves of the prejudices of our infancy, and to acknowledge nothing for Truth, but what we do clearly and diſtinctly underſtand ; and then, that we ought to give or deny our aſſent to nothing but what exactly anſwers to ſuch a clear perception and underſtanding of ours.

And becauſe all our knowledge is uncertain, as long as we are not ſure of a *Being abſolutely perfect*, from whom, as the Firſt Truth, all verities do depend ; he aſſerts the actual Exiſtence of ſuch a Being from the principles of *Des-Cartes.*

Then ſince from this ground, that there is a God, by whoſe power all things are produced, and that cannot deceive us, we are certain that we cannot err in the things which we clearly and diſtinctly know, he infers, that, ſeeing we have clear and diſtinct *Idea's* of *Corporeal* things, of which we are not the Cauſes, and which even occur often to us againſt our will, that, I ſay, thoſe idea's proceed from things without us, that do truly and actually exiſt in the world ; for elſe, *ſaith he*, if God ſhould immediatly impreſs ſuch conceptions upon our Minds, or cauſe them to proceed from an object, in which there were to be found nothing of *Extenſion, Motion, Figure,* &c. God could by no means be freed from deception. Whence it follows, according to our Author, that there is a *Subſtance extended in length, breadth, and depth,* call'd *Body*, the Object of *Phyſicks.*

Now, in theſe *Phyſicks* he excludeth all *Subſtantial Forms* from Body, and aſcribeth all the Corporeal Effects of Nature to the various Size, Figure, Scituation, Motion and Reſt of Bodies. And admitting, that a Material Subſtance conſiſts in the ſaid three Dimenſions, and is not really diſtinguiſh't from *Quantity*, he thinks, that 'tis eaſie to demonſtrate, there can be no *Vacuum* in Nature; that Rarefaction is not made but by an acquiſition of new matter, &c. Here he treateth of *Gravity*, which he maketh to conſiſt in this, that all the *Subtile Matter*, that is between Us and the Moon, being moſt ſwiftly mov'd towards the Earth, driveth down ſuch Bodies as are leſs ſwiftly mov'd. He diſcourſeth alſo at large of the Nature, Principle, and Laws of *Motion*; of *Time*, and *Place*; of *Hardneſs* and *Fluidity*; of *Denſity* and *Rarity*; of *Aſperity* and *Smoothneſs*, &c.

Moreover, he treateth of the Syſteme of the Univerſe, endeavouring to demonſtrate the Creation of the World by Natural Reaſon, and the Identity of the matter of Celeſtial and Terreſtrial Bodies. Thence he proceeds to explicate the nature and motion of the Heavens, Planets, and other Celeſtial Bodies; as alſo the nature of Light, and Comets, &c. Which done, he treateth of the Earth, and aſſerts its Motion with ſome new arguments, as he thinks. Then he conſiders the productions within and under the Earth; the nature and effects of the Loadſtone; the Flux and Reflux of the Sea; the nature of the Air and of the things generated therein; the nature of Fire; of Heat and Cold; of Thunder and Lightning, &c.

After this he undertaketh the Explication of *Man*: And therein, *Firſt* of the *Body* of Man, its parts and compoſition; where he maintains, that all the parts of the *fætus* are at firſt formed altogether in *utero*; and explains, How Nutrition is made; and how the Motion of the Heart, Arteries and Muſcles, and the Circulation of the Bloud is performed. Then he goes on to the doctrine of *Senſation*, and, among many other particulars, endeavours to ſhew that the Human Soul receives nothing, but foraſmuch as ſhe hath her Seat in the Brain. Which done, he diſcourſeth of Viſion, and Colours, and of the reſt of the Senſes. *Secondly*, of the *Soul* of Man, whoſe Immateriality and Immortality he is aſſerting; whereas the Soul of *Brutes*, in his opinion, is meerly *Mechanical*, and depends from nothing elſe but the diſpoſition of the Organs and the Influx of Spirits. To this part he Joins the doctrine of the *Paſſions* peculiar to Man, and aſcribable to him no otherwiſe than as he is a compound of Soul and Body.

He concludeth with his *Ethicks*, and ſhews, wherein conſiſts Man's supream Happineſs, the nature of Vertue, and Free Will.

III. *An Eſſay to the Advancement of MVSICK*; *by* Tho. Salmon, *M. A* London, 1672. *in* 8°.

THe deſign of this Eſſay is, to advance *Muſick* by caſting away the Perplexity of *Different Cliffs*, and Uniting all ſorts of Muſick, *Lute, Viol Violin, Organ, Harpſe-chord, Voice*, &c. in one Univerſal Character. And to give the Reader the judgment of an able Maſter in this Art concerning this Tract, he may pleaſe to take that of Mr. *John Birchenſha*, as 'tis extant in the Preface thereof to the Reader, *viz*.

Here is a well-deſign'd Epitome of *Practical* Muſick: For, by this happy contrivance, *the Cliffs, which were many, are reduced into an Univerſal Character; the various ſhifting of Notes in a Syſteme or Staff of lines are fixed; the neceſſity of their Tranſpoſitions taken away: So that he that can Sing or Play any one Part, may ſing or play all Parts; and he that ſhall know his diſtances in any one Part, may know them in all parts.*

The ſame Maſter declaring hereupon, that the benefit of this Eſſay will be ſo great to thoſe who ſhall make uſe of it, that he knows not what to deſire more advantagious for its acceptance, than an Experimental Tryal. Which herewith we recommend to the Ingenious Lovers of this Art.

Advertiſement.

WHereas *Theon Smyrnæus*, about 600 years ſince, had in a Greek Volume explicated all the Mathematical places in *Plato*, which Volume (as *Blancanus* in the end of his Appendix *In Ariſtotelis loca Mathematica* ſaith) *Joſephus Auria* long ago promiſed to publiſh, out of the *Vatican*, by himſelf rendred into Latin; The Publiſher of theſe Tracts, according to his engagement for the Reſuſcitation of obliging Antiquities, and for the Reſtauration and Advancement of the Liberal Arts, inquiring, what was performed therein, was aſſured by his Correſpondent from *Paris*, the ſaid *Theon* was there publiſh't ſome years ago by that Learned and Worthy perſon, *Iſmael Bullialdus*, in Greek and Latin together.

And now it is time to conſult for the reprinting of *Blancanus* in *Ariſtotelis loca Mathematica*, corrected, and with careful emendations of his *Mathematicorum Chronologia*; That ſuch as pretend to the great Names of *Ariſtotle* and *Plato*, may be invited by their authority and example, to learn thoſe Noble Arts. We alſo hope, that thoſe generous Spirits, who may have the help of good Libraries, will recover into publick light the beſt of Antient writers, illuſtrated by modern diligence, as we have now the Elements of *Diophantus Alexandrinus* his *Algebra*, with the Annotations of M. *Fermat* and M. *Bachet*, &c. See N. 72.

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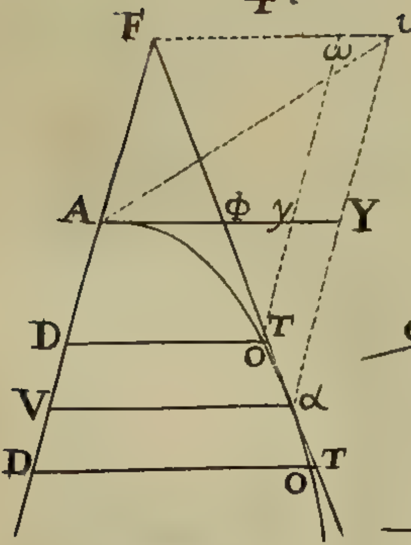

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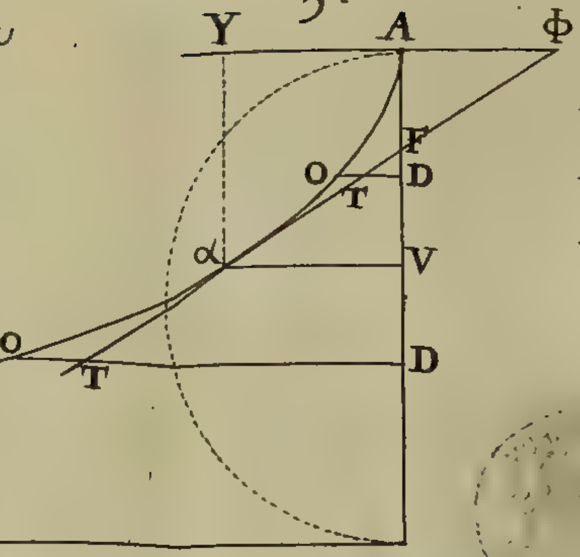

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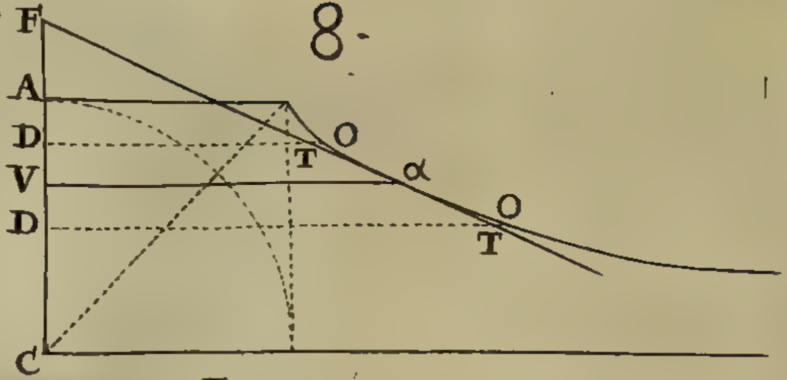

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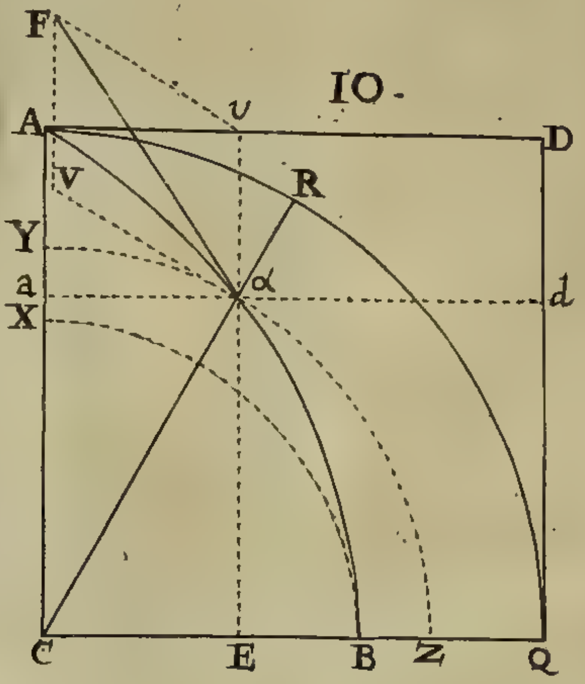

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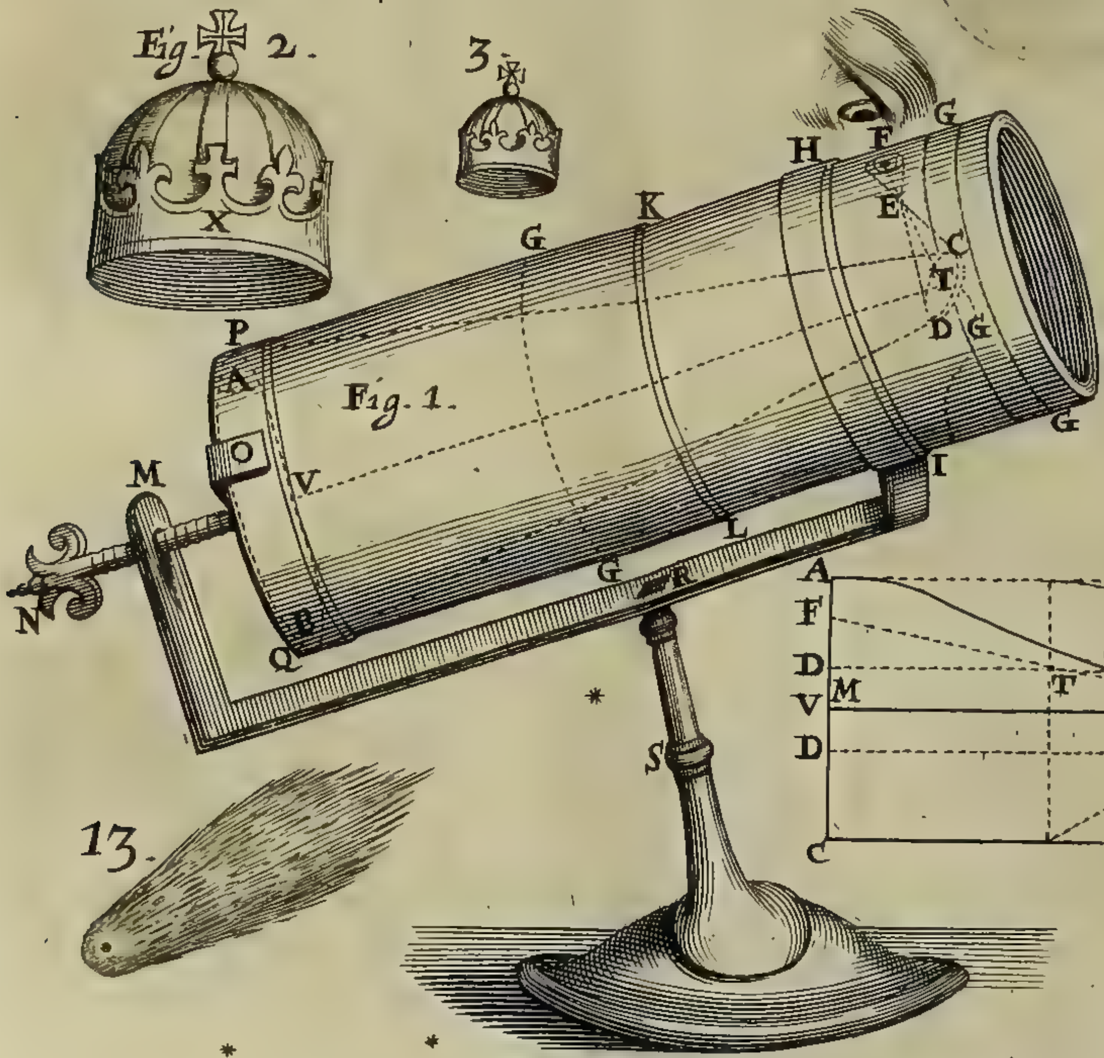

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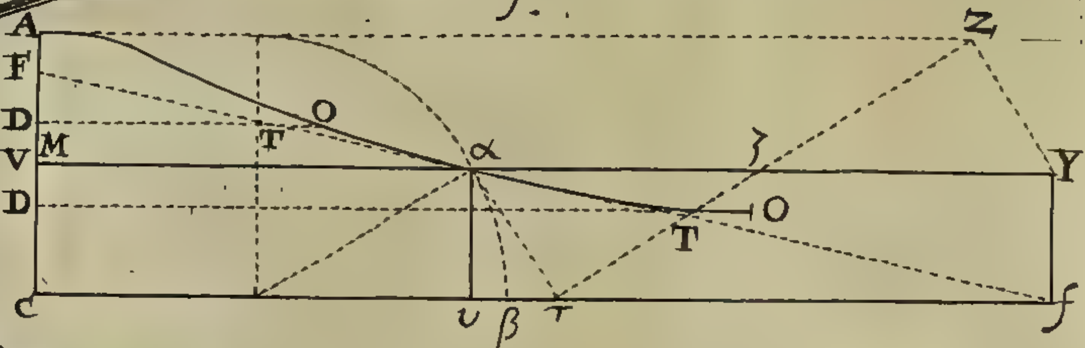

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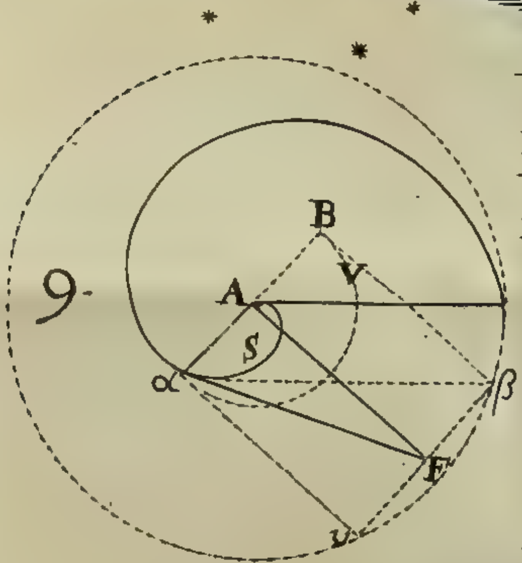

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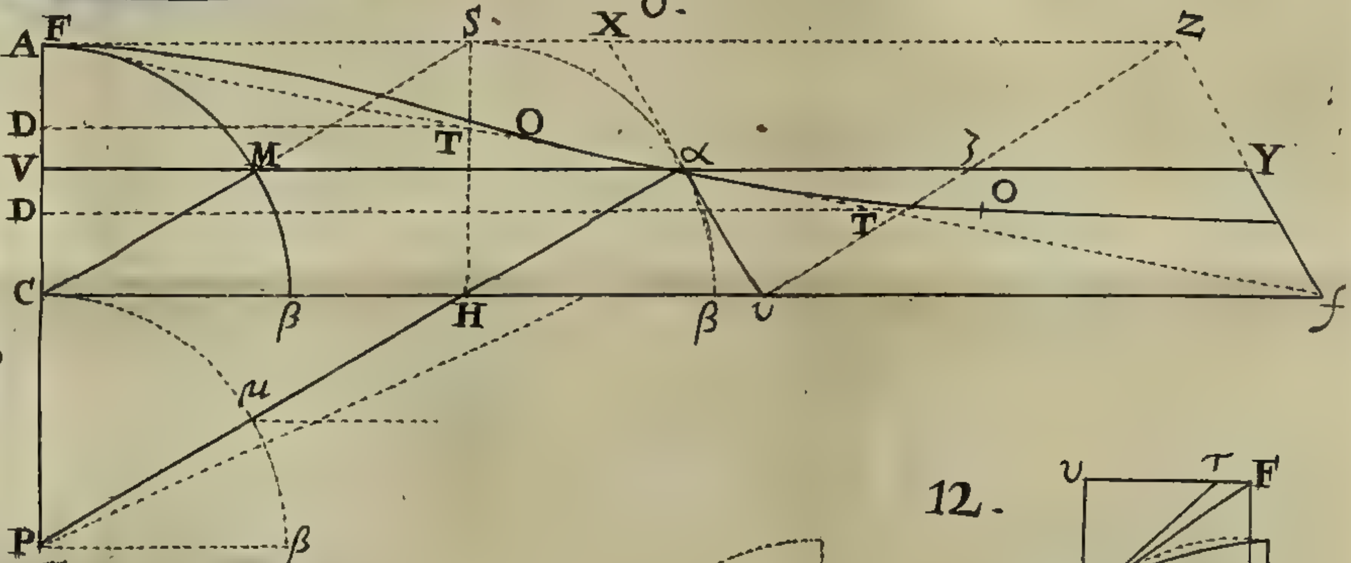

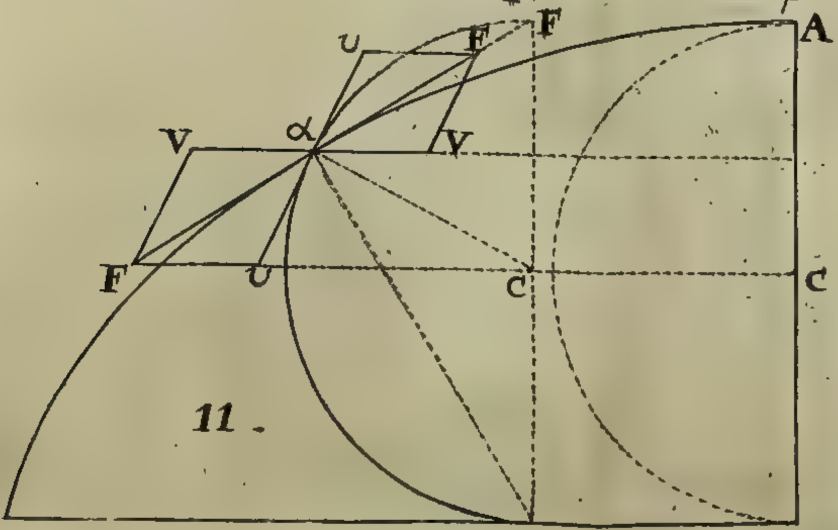

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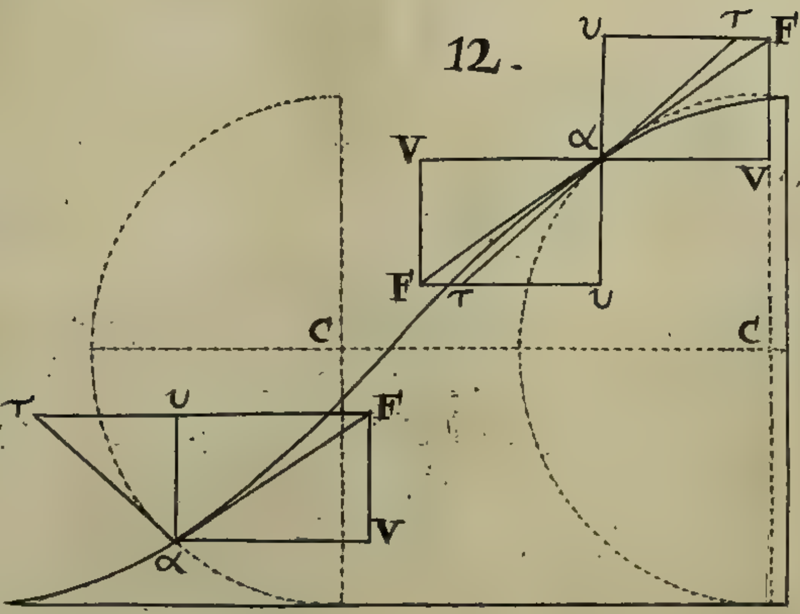

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Beginning the Eighth Year

PHILOSOPHICAL TRANSACTIONS.

March 25. 1672.

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A PREFACE TO *The Eighth YEAR.*

FOR *the Introduction to my* Sixth *Volume laſt foregoing, I borrow'd a few lines from our famous* Cowley; *here I ſhall make bold to take fuller and warmer encouragements from a Man of far greater renown, and for Learning and Devotion, jointly conſider'd, one of the Greateſt that hath appear'd in the Chriſtian world theſe* 1200 *years and upwards. 'Tis one, that giveth us the old Accompt of the addreſſes and affectionate reſpects, which Wiſe men bore towards Philoſophers, and one Philoſopher to another; and withall of the travels and perils they undertook by ſea and land, over rocks and mountains, and through inhoſpitable deſerts, to viſit the moſt Eminent at the remoteſt diſtances, and for the Acqueſt of Arts and knowledge. The perſon, I mean, is St.* Hierome, *and the words, wherein he gives us that relation, are theſe, De Sæculi hominibus;*

Legimus in veteribus Hiſtoriis quoſdam luſtraſſe provincias, novos adiiſſe populos, maria tranſiiſſe, ut eos, quos ex *libris* noverant, *coram* quoque viderent. Sic *Pythagoras* Memphiticos vates; ſic *Plato* Ægyptum & Architam Tarentinum inviſit, eamque oram Italiæ, quæ quondam Magna Græcia dicebatur, peragravit; ut qui Athenis *Magiſter* erat, & potens, cujuſque doctrinam Academiæ, Gymnaſia perſonabant, fieret peregrinus atque *Diſcipulus*; malens aliena verecundé diſcere, quàm ſua imprudenter ingerere: Denique, cùm literas quaſi toto Orbe fugientes perſequitur, captus à Piratis atque venundatus, etiam Tyranno crudeliſſimo paruit, ductus captivus, vinctus & ſervus; tamen *quia Philoſophus, major emente ſe fuit.* Ad *T. Livium*, lacteo eloquentiæ fonte manantem, de ultimis Hiſpaniæ Galliarumque finibus quoſdam veniſſe Nobiles legimus, & quos ad contemplationem ſui

Roma non traxerat, *unius hominis* fama perduxit; Habuit illa ætas inauditum omnibus ſæculis celebrandumque miraculum, ut Urbem tantam ingreſſi, aliud extra quærerent. *Apollonius*, ſive ille Magus (ut vulgus loquitur) ſive Philoſophus, ut Pythagorici tradunt, intravit Perſas, pertranſivit Caucaſum, Albanos, Scythas, Maſſagetas, opulentiſſima Indiæ regna penetravit, & ad extremum, latiſſimo *Phiſonis* amne tranſmiſſo, pervenit ad *Brachmanas*, ut *Hiarcham*, in throno ſedentem aureo, & de Tantali fonte potantem, inter paucos diſcipulos, de Natura, de Motibus ſiderum, ac dierum curſu audiret docentem. Inde per Elamytas, Babylonios, Chaldæos, Medos, Aſſyrios, Parthos, Syros, Phænices, Arabes, Palæſtinos, reverſus Alexandriam, perrexit in Æthiopiam, ut Gymnoſophiſtas & famoſiſſimam Solis menſam videret in ſabulo. Invenit ille Vir ubique quod diſceret, & ſemper proficiens, ſemper ſe melior fieret.

So far He; *by which lively and flagrant lines we may eaſily apprehend, what a reliſh this good Father had for the reputation of Philoſophy. And if any do wax pale at the growth of it, they ſeem to ſhew thereby, how little they have either of the intelligent Piety of this Holy man, or of the Civility of the Gentile Philoſophers.*

If it be objected, That here this Learned Father declares a Fondneſs for Apollonius, *as if none but the Vulgar had eſteemed him a Magician, but the Pythagoreans claim'd him for a Philoſopher; It may be conſider'd, that St.* Hierome *received this indulgent report from the Tradition of the more primitive Fathers, and particularly from* Juſtin Martyr, *who doubtleſs could diſcern deeper in Philoſophy, than Vulgar Heads, and might come nearer to the Truth than* Philoſtratus, *who perhaps might affect Romantique Stories. But* We *have no concernment for* Apollonius: *only we may vindicate the pious Father for his favourable ſentence; ſince we find it no new thing, that Great Philoſophers, Mathematicians and Un-common Artificers ſhould be defamed by the rude multitude for Magicians, or Atheiſts.*

We muſt grant, that in the laſt Age, when Operative Philoſophy *began to recover ground, and to tread on the heels* *of triumphant* Philology; *emergent adventures and great ſucceſſes were encountred by dangerous oppoſitions and ſtrong obſtructions:* Galilæus *and others in Italy ſuffered extremities for their Celeſtial Diſcoveries; and here in England Sr.* Walter Raleigh, *when he was in his greateſt luſter, was notoriouſly ſlaundered, to have erected a School of Atheiſm, becauſe he gave countenance to Chymiſtry, to practical Arts, and to curious Mechanical Operations, and deſign'd to form the beſt of them into a Colledge. And Queen Elizabeths* Gilbert *was a long time eſteem'd extravagant for his Magnetiſmes; and* Harvey *for his diligent reſearches in purſuance of the Circulation of the Blood.*

But, when our renowned Lord Bacon *had demonſtrated the Methods for a perfect Reſtauration of all parts of Real knowledge; and the Generous and Philoſophical* Peyreskius *had, ſoon after, agitated in all parts to redeem the moſt inſtructive Antiquities, and to excite Experimental Eſſays, and freſh Diſcoveries; The ſucceſs became on a ſudden ſtupendious, and Effective philoſophy began to ſparkle, and even to flow into beams of bright-ſhining Light, all over the World. And the ſaid* Peyreskius *his Orators,* Gaſſendus *and* Bucchardus, *have in their Hiſtories and Panegyricks raiſed him a more ſplendid Monument, than ſome of the greateſt Monarchs can ſhew. And it is remarkable, that when* Bucchardus, *a very eloquent Frenchman, had at Rome, in* Academia Humoriſtarum, *extolled, in a Funeral Oration, this his Countryman* Peyreskius *for one of the moſt wonderful Advancers of all kinds of Literature and of Arts that any age or place brought forth; yet he came off with univerſal applauſe, and devout acclamations, though Pope* Urban *the 8th, and his favourite-Cardinals, and ſeveral great Princes in Italy, and many excellent perſons in Rome, did then highly pretend, and might not unjuſtly lay claim to the patronage, and extraordinary merit in every kind of Learning, Art, and Elegancy.*

Theſe Vertues will ſhine brighteſt amongſt the Vertuous; and although the Emulation of Countries may grow hot, yet the beauty *of Vertue, and the* truth *of Philoſophy will prevail. The* Eaſt *and the* Brachmans *had the old Fame, (as the learned*

Father hath told us above,) but the Curious Monſieur Bernier *being lately returned from the* Mogolians, *gives us good aſſurance, that neither they, nor their* Brachmans, *are now worthy to teach the* Europeans; *but the Wiſeſt amongſt them do rejoyce in the philoſophical Light, which now ſhines in the* Weſt, *and in our* North. *And who knows, how ſoon or how potently our wonderfull progreſs of Arts, and the Luſtre of our Philoſophy may awaken* them, *to embrace the more glorious doctrine of the Goſpel. We hope, this Ingenious Travellour will make haſt to give us a* Philoſophical *accompt of his Travels, with no leſs accurateneſs, than he hath given us the* Political *Myſteries of the* Mogolians, *and the Sottiſhneſs of the Chriſtian Abyſſins or Æ*thiopians.

When the Emulation was hotteſt on both ſides the Alpes, *who ſhould excell in the flowry Arts of Oratory and Poetry, though* Sanazary *was then on one ſide of the* Alpes, *and far greater men, great Poets on the other ſide in* France; *yet both the* Scaligers, *Julius and Joſephus, themſelves Italians and French, gave the lawrel to* Buchanan *a Scot. And thus the Weſt or North-wind, bringing the ſweet* flowers *of Philology, and the richeſt* fruit *of Philoſophy, will be more wellcome to the Intelligent, than the fetid and contagious blaſts from the Eaſt. And the Wiſe and the Vertuous ought not to regard the Cenſures and reproaches of the ignorant or malignant Multitudes. They retain an internal ſatisfaction within themſelves; and ſound Philoſophers are mutually each to other ſufficient Theaters. I ſhall no longer detain the Curious and Ingenious Reader from the buſineſs we have in hand.*

An Accompt of a New Catadioptrical Teleſcope invented by Mr. Newton, *Fellow of the* R.Society, *and Profeſſor of the Mathematiques in the Univerſity of Cambridge.*

THis Excellent Mathematician having given us, in the Tranſactions of *February* laſt, an account of the cauſe, which induced him to think upon *Reflecting* Teleſcopes, inſtead of *Refracting* ones, hath thereupon preſented the Curious World with an *Eſſay* of what may be performed by ſuch Teleſcopes; by which it is found, that Teleſcopical Tubes may be conſiderably ſhortned without prejudice to their magnifying effect.

This new inſtrument is compoſed of two Metallin *ſpeculum's*, the one Concave, (inſtead of an Object-glaſs) the other Plain; and alſo of a ſmall plano-convex Eye-Glaſs.

By *Figure* I. of *Tab.* I. the ſtructure of it may be eaſily imagined; viz. *That* the Tube of this Teleſcope is open at the end which reſpects the object; *that* the other end is cloſe, where the ſaid Concave is laid, and *that* near the open end there is a flat oval *ſpeculum*, made as ſmall as may be, the leſs to obſtruct the entrance of the rays of Light, and inclined towards the upper part of the Tube, where is a little hole furniſh't with the ſaid Eye-glaſs. So that the rays coming from the object, do firſt fall on the Concave placed at the bottome of the Tube; and are thence reflected toward the other end of it, where they meet with the flat ſpeculum, obliquity poſited, by the reflection of which they are directed to the little plano-convex Glaſs, and ſo to the ſpectators Eye, who looking downwards ſees the Object, which the Teleſcope is turned to.

To underſtand this more diſtinctly and fully, the Reader may pleaſe to look upon the ſaid *Figure*, in which

A B is the Concave *ſpeculum*, of which the *radius* or ſemidiameter is $12\frac{2}{3}$ or 13 inches.

C D another metalline *ſpeculum*, whoſe ſurface is flat, and the circumference oval.

GD an Iron wire, holding a ring of braſs, in which the ſpeculum *CD* is fixed.

F, a ſmall Eye-glaſs flat above, and convex below, of the twelfth part of an inch *radius*, if not leſs; foraſmuch as the metal collects the Sun's rays at $6\frac{1}{3}$ inches diſtance, and the Eye-glaſs at leſs than $\frac{1}{6}$ of an inch diſtance from its vertex: Beſides that the Author (as he informs us) knew their dimenſions by the tools to which they were ground, and particularly meaſuring the diameter of the hemi-ſpherical Concave, in which the Eye-glaſs was wrought, found it the *ſixth* part of an inch.

GGG, the fore-part of the Tube faſtn'd to a braſs-ring HI, to keep it immoveable.

PQKL, the hind-part of the Tube, faſtn'd to another braſs-ring PQ.

O, an Iron hook faſtn'd to the Ring *PQ*, and furniſh't with a ſcrew N, thereby to advance or draw back the hind-part of the Tube, and ſo by that means to put the *ſpecula* in their due diſtance.

MQGI a crooked Iron ſuſtaining the Tube, and faſtned by the nail R to the Ball and Socket S, whereby the Tube may be turned every way.

The Center of the flat *ſpeculum* CD, muſt be placed in the ſame point of the Tube's Axe, where falls the perpendicular to this Axe, drawn to the ſame from the center of the little Eye-glaſs: which point is here marked at T.

And to give the Reader ſome ſatisfaction to underſtand, in what degree it repreſents things diſtinct, and free from colours, and to know the aperture by which it admits light; he may compare the diſtances of the *focus* E from the *vertex's* of the little Eye-glaſs and the Concave *ſpeculum*, that is, EF, $\frac{1}{6}$ of an inch, and ETV, $6\frac{1}{3}$ inches; and the *ratio* will be found as 1 to 38; whereby it appears, that the Objects will be magnified about 38 times. To which proportion is very conſentaneous, an Obſervation of the Crown on the weather-cock, about 300 feet diſtant. For the ſcheme X fig. 2. repreſents it bigger by $2\frac{1}{2}$ times in diameter, when ſeen through this, than through an ordinary Teleſcope of about 2 foot long. And ſo ſuppoſing this ordinary one to magnifie 13 or 14 times, as by the deſcription it ſhould, this new one by the Experiment muſt magnifie near as much as hath been aſſigned.

Thus far as to the ſtructure of this Teleſcope. Concerning the Metalline matter, fit for theſe reflecting *Speculums*, the Inventor hath alſo conſidered the ſame, as may be ſeen by two of his Letters, written to the Publiſher from Cambridge Jan. 18. and 29. $16\frac{71}{72}$. to this effect, *viz.*

1. That for a fit metalline ſubſtance, he would give this Caution, that whileſt men ſeek for a white, hard and durable metallin compoſition, they reſolve not upon ſuch an one, as is full of ſmall pores, only diſcoverable by a Microſcope. For though ſuch an one may to appearance take a good poliſh, yet the edges of thoſe ſmall pores will wear away faſter in the poliſhing than the other parts of the metal; and ſo, however the Metal ſeem polite, yet it ſhall not reflect with ſuch an accurate regularity as it ought to do. Thus Tin-glaſs mixt with ordinary Bell-metall makes it more white and apt to reflect a greater quantity of light; but withall its fumes, raiſed in the fuſion, like ſo many aerial bubles, fill the metall full of thoſe Microſcopical pores. But white Arſenick both blanches the Metall and leaves it ſolid without any ſuch pores, eſpecially if the fuſion hath not been too violent. What the *Stellate Regulus* of *Mars* (which I have ſometimes uſed) or other ſuch like ſubſtance will do, deſerves particular examination.

To this he adds this further intimation, that *Putty* or other ſuch like powder, with which 'tis poliſhed, by the ſharp angles of its particles fretteth the metall, if it be not very fine, and fills it full of ſuch ſmall holes, as he ſpeaketh of. Wherefore care muſt be taken of that, before judgment be given, whether the metall be throughout the body of it porous or not.

2. He not having tried, as he ſaith, many proportions of the Arſenick and Metall, does not affirm, which is abſolutely beſt, but thinks, there may conveniently be uſed

any quantity of Arſenick equalling in weight between a ſixt and eight part of the Copper, a greater proportion making the Metal brittle.

The way, which he uſed, was this. He firſt melted the Copper alone, then put in the Arſenick, which being melted, he ſtirred them a little together, bewaring in the mean time, not to draw in breath near the pernicious fumes. After this, he put in Tin, and again ſo ſoon as that was melted (which was very ſuddenly) he ſtirred them well together, and immediately powred them off.

He ſaith, he knows not, whether by letting them ſtand longer on the fire after the Tin was melted, a higher degree of fuſion would have made the metall porous; but he thought that way he proceeded to be ſafeſt.

He adds, that in that metall, which he ſent to *London*, there was no Arſenick, but a ſmall proportion of Silver; as he remembers, one ſhilling in three ounces of metall. But he thought withall, that the Silver did as much harm in making the metall ſoft, and ſo leſs fit to be poliſh't, as good in rendring it white and luminous.

At another time he mixed Arſenick one ounce, Copper ſix ounces, and Tin two ounces: And this an Acquaintance of his hath, as he intimates, poliſh't better, than he did the other.

As to the *objection*, that with this kind of Perſpectives, objects are difficultly found, he anſwers in another letter of his to the Publiſher, of Jan. 6. $16\frac{71}{72}$. that that is the inconvenience of all Tubes that magnifie much; and that after a little uſe the inconvenience will grow leſs, ſeeing that himſelf could readily enough find any day-Objects, by knowing which way they were poſited from other objects that he accidentally ſaw in it; but in the night to find Stars, he acknowledges it to be more troubleſome; which yet may, in his opinion, be eaſily remedied by two ſights affixed to the Iron rod, by which the Tube is ſuſteined; or by an ordinary perſpective glaſs faſtn'd to the ſame frame with the Tube, and directed towards the ſame object, as *Des-Cartes* in his Dioptricks hath deſcribed for remedying the ſame inconvenience of his beſt Teleſcopes.

So far the Inventors Letters touching this Inſtrument: of which having communicated the deſcription to Monſieur *Chriſtian Hugens de Zulichem*, we received from him an Anſwer to this effect, in his Letter of Febr. 13. 1672. ſt.n.

I ſee by the Deſcription, you have ſent me of Mr. *Newtons* admirable Teleſcope, that he hath well conſidered the advantage, which a *Concave ſpeculum* hath above *Convex glaſſes* in collecting the parallel rays, which certainly according to the calculation, I have made thereof, is very great. Hence it is, that he can give a far greater aperture to that *ſpeculum*, than to an Object-glaſs of the ſame diſtance of the *focus*, and conſequently that he can much more magnifie objects this way, than by an ordinary Teleſcope. Beſides, by it he avoids an inconvenience, which is inſeparable from convex Object-Glaſſes, which is the Obliquity of both their ſurfaces, which vitiateth the refraction of the rays that paſs towards the ſides of the glaſs, and does more hurt than men are aware of. Again, by the meer reflection of the metallin *ſpeculum* there are not ſo many rays loſt, as in Glaſſes, which reflect a conſiderable quantity by each of their ſurfaces, and beſides intercept many of them by the obſcurity of their matter.

Mean time, the main buſineſs will be, to find a matter for this *ſpeculum* that will bear ſo good and even a poliſh as Glaſſes, and a way of giving this poliſh without vitiating the ſpherical figure. Hitherto I have found no *Specula*, that had near ſo good a poliſh as Glaſs; and if M. *Newton* hath not already found a way to make it better, than ordinarily I apprehend, his Teleſcopes will not ſo well diſtinguiſh objects, as thoſe with Glaſſes. But 'tis worth while to ſearch for a remedy to this inconvenience, and I deſpair not of finding one. I believe, that M. *Newton* hath not been without conſidering the advantage, which a *Parabolical ſpeculum* would have above a *Spherical* one in this conſtruction; but that he deſpairs, as well as I do, of working other ſurfaces than ſpherical ones with due exactneſs; though elſe it be more eaſie to make a *Parabolical* than *Elliptical* or *Hyperbolical* ones, by reaſon of a certain propriety of the *Parabolick Conoid*, which is, that all the Sections parallel to the Axis make the ſame Parabola.

Thus far M. *Hugenius* his judicious Letter; to the latter part of which, concerning the grinding *Parabolical Conoids*, Mr. *Newton* ſaith, in his Letter to the Publiſher of Feb. 20. 71. that though he with him deſpairs of performing that work by Geometrical rules, yet he doubts not but that the thing may in ſome meaſure be accompliſhed by Mechanical deviſes.

To all which I cannot but ſubjoyn an Extract of a Letter, received very lately, (March 19th) from the Inventor *of this new Teleſcope, from* Cambridge, *viz.*

In my laſt Letter I gave you occaſion to ſuſpect, that the Inſtrument which I ſent you, is in ſome reſpect or other indiſpoſed, or that the metals are tarniſhed. And by your Letter of *March* 16. I am fully confirmed in that opinion. For, whileſt I had it, it repreſented the Moon in ſome parts of it as diſtinctly, as other Teleſcopes uſually do which magnifie as much as that. Yet I very well know, that that Inſtrument hath its imperfections both in the compoſition of the metall, and in its being badly caſt, as you may perceive by a ſcabrous place near the middle of the metall of it on the poliſhed ſide, and alſo in the figure of that metall near that ſcabrous place. And in all thoſe reſpects that inſtrument is capable of further improvement.

You ſeem to intimate, that the proportion of 38 to 1 holds only for its magnifying Objects at ſmall diſtances. But if for ſuch diſtances, ſuppoſe 500 feet, it magnifie at that rate, by the rules of Opticks it muſt for the greateſt diſtance imaginable magnifie more than $37\frac{3}{4}$ to 1; which is ſo conſiderable a diminiſhing, that it may be even then as 38 to 1.

Here is made another Inſtrument like the former, which does very well. Yeſterday I compared it with a ſix foot Teleſcope, and found it not only to magnifie more, but alſo more diſtinctly. And to day I found, that I could read in one of the *Philoſophical Tranſactions*, placed in the Sun's

light,

light, at an hundred foot diſtance, and that at an hundred and twenty foot diſtance I could diſcern ſome of the words. When I made this tryal, its Aperture (defined next the Eye) was equivalent to more than an inch and a third part of the Object-metall. This may be of ſome uſe to thoſe that ſhall endeavour any thing in *Reflexions*; for hereby they will in ſome meaſure be enabled to judge of the goodneſs of their Inſtruments, &c.

N. B. The Reader may expect in the *next Month* another Letter, which came ſomewhat too late to be here inſerted; containing a *Table*, calculated by the ſame Mr. *Newton*, about the ſeveral *Apertures* and *Charges* anſwering the ſeveral *Lengths* of theſe Teleſcopes.

EPITOME

Binæ Methodi *Tangentium* Doctoris *Johannis Walliſii* Geom. Prof. Saviliani *Oxoniæ*; aliàs fuſius & explicatius ab ipſo traditæ, hîc verò ob anguſtiam loci compendifactæ: In quarum Schematiſmis ſi forſan literæ quædam redundaverint, illæ ad ea pertinere cenſendæ ſunt, quæ in ampliori ejuſdem Scripto continentur, hîc vero dictâ de cauſa omittantur.

Habes hic (Clariſſime vir) eorum ſummam (ſtrictim traditam) quæ fuſiùs ſcripſeram, meas de Tangentibus Methodos *ſpectantia; duas potiſſimum quibus præſertim utor; alteram in Speciebus, alteram in Lineis; utramque generali formâ facilè explicabilem.*

Priorem adhibeo Con.Sect.prop.23,30,36,46,49. *& paſſim alibi. Quæ hæc eſt.*

Expoſitâ Curvâ $A\alpha$, *(putà* Parabola, fig.4.) *quam in* α *tangat* αF, *diametro* VDA *occurrens in* F; *ordinatim applicentur* αV, *&* DOT *curvæ in* O *& tangenti in* T *occurrens. Ponatur autem* $V\alpha = \mathrm{b}$, $VA = \mathrm{v}$, $VF = \mathrm{f}$, $VD = \mathrm{a}$, *adeóque* $DA = \mathrm{v} \pm \mathrm{a}$, $DF = \mathrm{f} \pm \mathrm{a}$;

Eſt (propter ſimilia triangula) $VF.DF :: V\alpha.\ DT = \frac{\mathrm{f} \pm \mathrm{a}}{\mathrm{f}}\mathrm{b}$.

Item, ſi tangens ſit ultra curvam, $DT \overline{>} DO$; *ſi citra,* $DT \overline{<} DO$: *Nempe,* $DT = DO$ *ſi intelligatur* D *in* V; *ſed, ſi extra* V, DT *vel* DO *major prout tangens eſt ultra citrave curvam.*

Tum, habita ipſius DO deſignatione quæ ſit expoſitæ curvæ accommodata; (puta, in Parabola, propter AV. AD :: Vaq. DOq$=\frac{v\pm a}{v}b^2$; *DO*$=b\sqrt{\frac{v\pm a}{v}}$:) *fiat debita reductio, (puta, propter* $\frac{f\pm a}{f}b \overline{>} b\sqrt{\frac{v\pm a}{a}}$, *adeoque* $\frac{f^2\pm 2fa+a^2}{f2}\overline{>}\frac{v\pm a}{v}$, & $f^2v\pm 2fva+va^2 \overline{>} f^2v\pm f^2a$; *deletis utrinque æqualibus, hoc eſt, iis omnibus in quibus* a *non conſpicitur; cæteriſque per* $\pm a$ *diviſis*: $2fv\pm va \overline{>} f^2$.)

Tandem (qui methodi nucleus eſt) poſito D *in V, (quò ſit* $a=0$, *adeoque evaneſcant ipſius multipla omnia,) æquatio exhibebit* f *quæſitam (puta* $2fv\pm va=2fv=f^2$, *adeoque* $2v=f$.)

Hanc (locis citatis) accommodatam videas Parabolæ, Ellipſi, Circulove, Hyperbolæ, Paraboloidibus omnibus, (quibus & harum Reciprocas accenſeo,) atque alibi aliis.

Ciſſoidi (fig.5.) *ſic accommodes. Eſt (per* cap. 5. pr.29. de Motu) $V\alpha=b=\frac{v^2}{s=\sqrt{vh}}$, *(poſito* s *pro ſinu recto in circulo generante, cujus radius* r, *ſinus verſus* v, & $2r-v=h$, & $h-v=2\varkappa$,) *adeoq;* (*ſubſtitutis* $v\pm a$ *pro* v, & $h\mp a$ *pro* h,) $\frac{v^2\pm 2va+a^2}{\sqrt{:vh\pm 2\varkappa a-a^2:}}$ (= *D O* $\overline{>}$ (*DT*$=\frac{f\pm a}{f}b=$)$\frac{f\pm a}{f}\times\frac{v^2}{\sqrt{vh}}$. *Ergo (ſumptis quadratis, & multiplicando decuſſatim,)* $f^2v^5h+6f^2v^3ha^2+f^2vha^4\pm 4f^2v^4ha\pm 4f^2v^2ha^3 \overline{>} f^2v^5h\pm 2fv^5ha+v^5ha^2\pm 2f^2v^4\varkappa a+4fv^4\varkappa a^2\pm 2v^4\varkappa a^3-f^2v^4a^2\mp 2fv^4a^3-v^4a^4$: *item (deletis utrinque æqualibus, cæteriſque per* $\pm va$ *diviſis*) $\pm 6f^2v^2ha\pm f^2ha^3+4f^2v^3h+4f^2vha^2 \overline{>} 2fv^4h\pm v^4ha+2f^2v^3\varkappa\pm 4fv^3\varkappa a+2v^3\varkappa a^2\mp f^2v^3a-2fv^3a^2\mp v^3a^3$. *Denique (poſito* D *in V, quo evaneſcat* a *cum ſuis multiplis, cæteriſque per* fv^3 *diviſis) fiet æquatio* $2fh-f\varkappa=vh$, *adeoque* $\frac{vh=s^2}{2h-\varkappa=r+h=3r-v}=f$.

Idem ſuccedet, ſumptâ, pro VA, diametro YA, (cui tangens occurrat in Φ) *aliâ VC. Item, ſi exponeretur curva quæ ordinatas non habeat, ſed quæ bis æquipolleant; ut ſunt, in Spirali, creſcentes radii.*

Sed & calculi magna pars præverti poteſt; omiſſis ab initio (utpote pòſt reÿciendis) terminis iis ubi habetur a^2 *vel ſuperior hujus poteſtas; item iis in quibus nec* a *conſpicitur, nec ſunt in* a *ducendi, (utpote æqualibus utrinque prodituris.) Exempli gratiâ,* *In* Conchoide, (fig 6.) *cujus ordinata* $V M\alpha$ *conſtat ex ſinu recto* $VM = s = \sqrt{vh}$, *& tangente* $M\alpha = CH = \frac{s}{\kappa} r$, (*ſi ſit* $CP = CA = r$, *adeoque* $CH = AS$;) *ſaltem* $= \frac{s}{\kappa} \varrho$ (*poſito* $CP = \varrho$:) *adeoque* $V\alpha = b = s + \frac{s}{\kappa} r = \frac{\kappa + r}{\kappa} s = \frac{h}{\kappa} s$, *ſaltem* $\frac{\kappa + \varrho}{\kappa} s = \frac{\nu}{\kappa} s = \frac{\nu}{\kappa} \sqrt{vh}$ (*poſito* $\kappa + \varrho = \nu$.) *Ergo* $DT = \frac{f \pm a}{a} b = \frac{f \pm a}{f \kappa} \nu \sqrt{vh} \gtreqless DO = \frac{\nu \mp a}{\kappa \mp a} \sqrt{:vh \pm 2\kappa a -:}$ (*omitto* a^2, *quia poſt delendum, indeque oriunda, & ſic ſemper:*) &, *ſumptis quadratis*, $\frac{f^2 \pm 2fa +}{f^2 \kappa^2} \nu^2 vh \gtreqless \frac{\nu^2 vh \pm 2\nu^2 \kappa a \mp 2\nu vha \pm}{\kappa^2 \mp 2\kappa a -}$ (*hoc eſt*, $\overline{>}$ *ſupra, ſed* $\overline{<}$ *infra, punctum flecus contrarii.*) *Et, decuſſatim multiplicando; omiſſis (ut præcipitur)* $f^2 \kappa^2 \nu^2 vh$ *utrobique, omnibuſque* a^2 *multiplis; cæteroſque per* $\pm a$ *diviſis;* $2f\nu^2 vh\kappa^2 - 2f^2 \nu^2 vh\kappa \pm \gtreqless 2f^2 \nu^2 \kappa^3 - 2f^2 \nu vh\kappa^2$: *adeoque* (*poſito D in V*,) $\nu vhr = f\nu vh + f\nu\kappa^2 - fvh\kappa = f\nu r^2 - fvh\kappa$ (*propter* $vh + \kappa^2 = s^2 + \kappa^2 = r^2$,) & $f = \frac{vh = s^2}{\nu r^2 - vh a \kappa} \nu \kappa$. *Et quidem, in primaria*, (*propter* $h = \nu$,) $f = \frac{s^2 \kappa}{r^2 - \kappa}$.

In Figura Tangentium (fig.7.) *quæ à Conchoide differt, exempto quadrante genitore; idem erit proceſſus, niſi quod, propter* $V\alpha = M\alpha = \frac{\varrho}{\kappa} s$ (*non* $\frac{\nu}{\kappa} s$,) *prodibit (ſive in primaria, ſive in protracta contractave,)* $f = \frac{vh = s^2}{r^2} \kappa$.

In Figura Secantium (fig.8.) *propter* $V\alpha = b = \frac{r^2}{\kappa}$; *erit* $DO = \frac{r^2}{\kappa \mp a} \overline{>} \frac{f \pm a}{f \kappa} r^2 = DT$. *adeoque* $f = \kappa$.

Cumque hæc curva ſit Hyberbola (per pr.30.cap.5.& pr.1.cap. 15. de Motu,) *cujus Aſymptotæ CA, Cβ: eadem tangens habetur per* pr. 36.Con. ſect. *Cumque ordinatæ ad aſymptotas (per* pr. 94, 95, Arith. Infin.) *ſint* ſeries Reciproca Primanorum (*quæ ad Paraboloïdium genus ſpectat, verticem habens C, exponentem* −1,) *habetur eadem tangens per* prop. 49. Con. Sect. (*eademque eſt expedita methodus pro hyperbolæ cujuſvis tangente per aſymptotam inveniendâ.*) *Quippe, in Paraboloïdibus omnibus, ut intercepta diameter VC, ad VF, ſic* 1 *ad exponentem: hoc eſt, in præſenti caſu, ut* 1 *ad* −1; *adeoque VC=VF, ſed (propter contraria ſigna* + −) *ad contrarias partes.*

Notandum hic; in Parabolâ, Paraboloïde, Hyperbolâ, Ellipſi, &c. figurâve Sinuum (rectorum, verſorumve,) Arcuum, Tangentium,

gentium, Secantium, &c. aliâve cujus conſtructio eſt Similaris ; protractio contractiove figuræ (ſeu mutatio Lateris-recti, aut quod hujus inſtar eſt,) non mutat punctum F, (eo quod Latus-rectum æquationem quæ longitudinem VF determinat non ingrediatur, utut eam ingrediatur quæ determinat longitudinem Vα, mutetque angulos ad α & F :) ſed ubi conſtructio eſt Diſſimilaris, ut in Cycloïde & Conchoïde (propter ordinatam illic ex Sinu & Arcu, hîc ex Sinu & Tangente, conflatam,) aliiſque iſtiuſmodi, res ſecus eſt : eò quòd una pars (ut Arcus in Cycloïde & Tangens in Conchoïde) protrahitur contrahiturve, manente alterâ (putà, in utriſque Sinu recto) ut in primariâ.

Idemque dicendum de Angulo applicationis (ad V,) cujus mutatio non mutat longitudinem VF, ſed neque Vα, quia neutrius ingreditur æquationem. Atque hinc fit, quòd in figura Scalena, quæ ordinatas contrarias, utrinque ad V poſitas, ſpectant tangentes, utut inæquales, in eodem F conveniant. Sed & (ut hoc obiter moneam) quadratorum aggregatum habent idem atque in erectâ ; nempe ſemper $= 2\,V\alpha\, q + 2\,VF\, q$.

Eſtque hæc mihi methodus pro Maximis & Minimis *in omne genus quantitatibus.*

Methodus altera (ſecundùm tradita de Angulo Contactus & Arithm. Infin.) *curvam conſiderat tanquam ex particulis conflatam infinitè exiguis, ſed certam poſitionem habentibus ; eandem nempe (propter contactûs angulum ſive nullius magnitudinis ſive infinitè exiguæ) cum recta ibidem tangente : adeoque cum hac (reſpectu cujuſvis rectæ) pariter declivem, (ut eſt Montis Aα* fig. 4, 5, *declivitas in α, eadem quæ tangentis αF.) Cujus ergo quæque particula (per* cap. 2. de Motu) *eſt in eâ ratione magis longa (quàm eſt reſpectiva expoſitæ rectæ particula æquè-alta) quâ eſt minùs declivis ; puta αT quàm VD : Unde, propter mutatam in ſingulis punctis declivitatem, oritur ſeries longitudinum inæqualium in curvâ, ſeriei æqualium in rectâ, reſpondens ; curvæ ad rectam rationem exhibens. Atque hinc methodus mea pro* curvis rectificandis, (ſchol. prop. 38. Ar. Infin. *inſinuata,) quam proſequor tractatu de* Ἐυθύνσει, *item* de motu cap. 5. prop. 13. & ſeqq. *Cujus aliqua pars eſt hæc de Tangentibus, ut quæ non totam declivitatum ſeriem perpendit, ſed eam quæ eſt in expoſito puncto.*

Hanc reſpectivam particularum longitudinem, aliàs inſinuatum *eunt (motu forinſecus aſſumpto) per motuum quibus tranſigantur ἰσοχρόνων celeritatem.* (*Quippe idem eſt, in Motu, Celeritas, atque hæc, in Situ (propter poſitionem obliquam ſeu minus declivem) reſpectiva Longitudo.) Aptiſſimè quidem in lineis à motu primitus oriundis, (putà, Cycloide, Conchoide, Spirali, Quadratrice, &c.) nec ineptè in aliis, quæ fingi ſaltem poſſunt iſtiuſmodi motibus deſcribi.*

Præſumo autem (ex prop. 15. cap. 2. de Motu) *eam eſſe curvæ in quovis puncto directionem, adeoque & declivitatem, quæ eſt rectæ ibidem tangentis: Item (ex* prop. 6. cap. 10.) *Motûs compoſiti directionem eſſe in Diagonio parallelogrammi, cujus latera & anguli exhibeant componentium celeritates & directiones.*

Intelligatur jam (fig. 4.) $A\alpha$ parabola, *deſcribi motu compoſito, ex æquabili ſecundum* $A\Upsilon$ *vel* $V\alpha$, *cujus itaque particulæ ἰσόχρονοι* (*per* pr. 3. cap. 10. de Motu) *ſunt ſeries Primanorum, quæ ad ſeriem totidem ultimæ æqualium, (hoc eſt, ad rectam ἰσόχρονον celeritate in* α *acquiſitâ tranſigendam,) eſt ut* 1 *ad* 2, (*per* Ar. Infin. pr. 64. *vel* pr. 1. cap. 5. de Motu.) *Adeoque, ſumpta* $VF = 2VA$, *& compoſito* $FV\alpha\upsilon$ *parallelogrammo; juncta* αF *eſt Tangens.*

Idem ſimiliter obtinebitur in Paraboloidibus quibuſcunque, ope prop. 2, 5, 6, 7, de Motu.

Atque inde facile (vel ex iiſdem principiis) oſtenditur; ſi intelligatur Fig. $A\Upsilon\upsilon$ *ſic conſtituta, ut momenta (reſpectu* AF*) ordinatorum* $\Upsilon\upsilon$, $y\omega$, *ſint ipſis* $\Upsilon\alpha$, yO, *ordinatis proportionalia; erunt Celeritates acquiſitæ in* α, o, *ſeu* V, D, *(poſitâ* $A\Upsilon$ *linea motûs æquabilis) rectis* $\Upsilon\alpha$, $y\omega$, *proportionales: Et conſequenter, ut* $A\upsilon\Upsilon$ *(illarum aggregatum) ad* $AF\upsilon\Upsilon$ *(aggregatum totidem maximæ æqualium,) ſic* VA *(aggregatum celeritatum ſeu particularum creſcentium) ad (aggregatum totidem maximæ æqualium)* ΥF.

Spiralis $AS\alpha$ (fig. 9.) *punctum* α *deſignatur motu compoſito ex recto per* $A\alpha$, *& circulari per* $V\alpha$, *æquabilibus utriſque & ἰσοχρόνοις. Ergo, ſumpta circuli tangente* $\alpha\upsilon = \alpha V$, *& completo* $A\alpha\upsilon F$ *parallelogrammo; juncta* αF *Spiralem tanget.*

Unde ſtatim emergit Archimedea quadratura (ſive Circuli ſive Sectoris cujuſvis) propter $AF = \alpha\upsilon = \alpha V$.

Sin motuum alter, puta $A\alpha$, *ſit acceleratus vel retardatus; pro*

αA, ſumenda erit αB (in ea ad illum ratione quam illa poſtulat acceleratio ſeu retardatio,) eritque diagonium $\alpha\beta$, Tangens quæſita.

Quadratricis $A\alpha B$ (fig. 10.) punctum α deſignatur motu compoſito ex recto per $\upsilon\alpha$, & circulari in $\Upsilon\alpha$ (æquabilibus & ἰσοχρόνοις.) Ergo, ſumpta tangente $\alpha V = \alpha\Upsilon$, & completo parallelogrammo $V\alpha\upsilon F$, juncta αF tanget Quadratricem.

Atque hinc alia quadratura, per Tangentem quadratricis, propter $\upsilon F = \alpha V = \alpha\Upsilon$.

Illa per quadratricis Baſin, ſic elicitur. Poſitis $CA = r$, $AQ = q$, $\Upsilon Z = \chi$, $QR = a$. Erit (propter Quadratricis conſtructionem) $AQ.\ RQ :: AC.\ AE = .\ \frac{a}{q} r :: \Upsilon Z.\ \alpha Z = \frac{a}{q}\chi$. Eſtque $\alpha Z \sqsupset \alpha E$ ſumpto ubivis in AB puncto α, præterquam in B, quo caſu (evaneſcente utraque) erit $\alpha Z = \alpha E$, adeoque $\chi = r$; hoc eſt, $\Upsilon Z = XB = AC$. Sed & υE communis tangens utrique curvæ XB, AB.

Cycloïdis (fig. 11.) punctum α deſcribitur motu compoſito, ex recto in αV, & circulari in $\alpha\beta$ (æquabilibus & æquè-velocibus.) Ergo, ſumpta tangente $\alpha\upsilon = \alpha V$, & completo $V\alpha\upsilon F$ parallelogrammo, juncta αF Cycloidem tanget. Et quidem, propter Ang. $\upsilon\alpha F\ (= \alpha\beta F = \frac{1}{2}\alpha CF) = \frac{1}{2}\upsilon\alpha V$, occurret circuli $\alpha\beta$ erectæ diametro in vertice.

In ſecundariis (contractâ protractâve) ſumenda erit $\alpha\upsilon$ ad αV, in ea ratione major minorve, quâ eſt celeritas motûs circularis ad celeritatem recti.

In Figura Arcuum, Sinuumve, (fig. 12.) procedendum ut in Cycloide, niſi quòd (propter exemptum ſemicirculum genitorem) pro tangente $\alpha\upsilon$ illic (quæ hîc eſt $\alpha\tau$) ſumenda erit erecta $\alpha\upsilon$ æque-alta.

Conchoidis (fig. 6.) punctum α deſignatur motu compoſito, ex æquabili circulari in $\alpha\beta$ (hujuſve tangente $\alpha\upsilon$) & recto in $\alpha\Upsilon$ accelerato pro incremento tangentium: quæ quidem acceleratio duplex eſt, altera propter declivitatis angulum $\beta\alpha\Upsilon$, hoc eſt, $\upsilon\alpha\Upsilon$, continuè creſcentem; altera propter radii in ſecantem protractionem, continuè item creſcentem. Propter priorem, ducta tangente $\alpha\upsilon$ (quæ occurrat in υ regulæ CH,) recta $\upsilon\zeta$ (parallela rectæ $PH\alpha$,) occurrat $\alpha\Upsilon$ in ζ: Propter poſteriorem; eadem $\upsilon\zeta$ protracta occurrat tangenti verticis in Z: indeque $Z\Upsilon$ rectæ $\upsilon\alpha X$ parallela; adeoque $\alpha\Upsilon = XZ$.

αζ :: CM . MS :: Pμ . PH. Completo denique Υαυf parallelogrammo, juncta αf tanget conchoidem.

In ſecundariis (ubi non eſt CP=CA,) ſumenda erit αΥ ad jam deſignatam, ut eſt CP ad CA.

In Figura Tangentium (fig. 7.) *propter exemptum Conchoidi quadrantem genitorem, pro tangente αυ illic (quæ hîc eſt ατ) ſumenda erit erecta αυ æquè-alta.*

Pluribus exemplis proferendis ſuperſedeo. Moneo tamen, utramvis Methodum, utut tangentibus rectis hîc accommodatam, extendi poſſe ad mutuum Curvarum tactum. Puta; ſi, pro FVα triangulo (fig. 4,5,) *intelligatur Hyperbola; recta DT, quæ hîc inſignitur charactere qui triangulo conveniet, ſubire tum debebit characterem Hyperboles; cujus vertex F ſimili proceſſu quæratur. Similiſque in poſteriori methodo accommodatus eſt linearum ductus. Et quidem, cum curvam Aα tangens recta αF, ſit etiam tangens communis curvarum omnium, expoſitam ibidem tangentium; prout hic, ex data Aα curva quæritur recta αF, ſic ex hac datâ (per eandem methodum inverſam) quærenda erit alia tangens curva, modò ſatis ſit determinata.*

Sed ampliandum non eſt. Tu itaque Vale.

Tuus

Oxoniæ *die* 15.
Febr. 1671.

Johannes Wallis.

Extract

Extract of a Letter of Monſieur Hevelius *from* Dantzick *written to the Publiſher in* Latin, *March* 9. (*ſt. nov.*) 1672; *giving ſome Accompt of a* New Comet, *lately ſeen in that Country: Engliſhed as followeth.*

—I Shall not excuſe my long ſilence, but acquaint you in brief with a New Appearance in the Heavens. There hath been ſeen here a *New Comet* from the 2*d* of March 1672; which I my ſelf, being ſome daies abſent from home and from my inſtruments, could not obſerve till March 6*th* in the evening. It is ſeen both mornings and evenings. It is but little, having at the preſent a train not above a degree or a degree and an half long: which would doubtleſs appear bigger, if it were not for the twy-light, and the Moon were abſent. It is now about the Stars in the right Arm of *Andromeda* on her Shoulder-blade. See *Fig.* 13. *Tab.* 1. As far as I can collect from one or two obſervations, it tends towards the *Lucida* of *Andromeda's* girdle, and that with a direct diurnal motion of about two degrees in its courſe.

The 6*th* of March in the evening, h. 7. 40′. it was in grad. 7. of ♈ in the 35*th* deg. of Northern Latitude; as I gueſſed by the haſty inſpection of a Globe.

March 7. in the morning h. 3.30′. its Longitude was about 8. deg. ♈, with a ſomewhat leſſer latitude than before: in the Evening of the ſame day its Longitude was 10. deg. ♈, and Latitude 34. deg. *ferè*.

March 8. in the morning h. 4. the Longitude was 12. deg. ♈. and the Latitude 33. deg: Which yet I would not have taken preciſely, becauſe I cannot yet reduce my Obſervations to a *calculus*. This evening, I hope, I ſhall ſee him again; although this morning we could ſee nothing by reaſon of the dark weather.

I intend to ſend you by the next more particular and more accurate Obſervations, which I purpoſe to make carefully, as oft as I can, with my Braſs Octant, which is about 9 feet long. And I long to hear, what you or other Nations have obſerved of this Phenomenon.

Beſides, I cannot but advertiſe you, that I have obſerved again March 6. 1672. the New Star under the Head of the Conſtellation of the *Swan*; but it can hardly be ſeen as yet with the naked Eye.

So far this diligent Obſerver; with whoſe Obſervations we preſently acquainted ſome of our Aſtronomers here, to excite them to make theirs alſo in this place; who yet have ſeen nothing of this Comet hitherto.

Mean time we have received freſh Letters from *Paris*, informing us, that there, and at *La Fleſche* alſo, it hath been ſeen, from *March* 16 (ſt. n.) untill *March* 26; both incluſively: Of which we expect a particular account hereafter. At the preſent they intimate, that the reaſon why it hath not been obſerved but very late, is, that for a good while it was near the Sun; and when it was got clear of him, it was much obſcured by the Moon.

Since this, we have been informed by our Worthy and Learned Friend Mr. *Iſaac Newton*, that about the *16th* of *March* $16\frac{71}{72}$, ſt. v. he ſaw at night a dull Star South-weſt of *Perſeus*, which, *he ſaith*, he now takes to have been that *Comet*, of which we gave him information: But he adds, that it was very ſmall, and had not any viſible Tail, which made him regard it no further; he fearing withall, that it will now be difficult to find it.

An Account of what hath been of late obſerved by Dr. Kerkringius *concerning Eggs to be found in all ſorts of Females.*

ALthough we have already (N°. 70.) taken notice in brief of what the Inquiſitive *Kerkringius* hath diſcourſed of, concerning *Ovaria* and *Ova* in all ſorts of Femals; yet, to excite the more vigorouſly our eminent Anatomiſts here to a further ſearch into this matter, as thoſe of that profeſſion in many forrain parts, as *France, Italy, Holland*, &c. employ themſelves to find what truth there is in it; we thought, it would not be unwelcome to the Curious of all ſorts of this Country, to give them here in *Engliſh* a particular deſcription of what the ſaid *Kerkringius* hath from his own Obſervations delivered on this ſubject: In the doing of which we ſhall not ſcruple to follow the French Philoſophical *Journals*, publiſhed *March* 15. 21, and 22, to this effect;

What Doctor *Kerkring*, (ſaith one of them) hath from his curious Obſervations advanced, *viz.* That Man hath his origin from an Egg, hath been very differently received, ſome appearing ſurpriſed at it, others rallying with it, and many being induced thereby to make further inquiry into it. This great diverſity of ſentiments made me think, I ſhould do well for the ſatisfaction of all ſorts of people, to inſert here the particulars themſelves, obſerved by the ſaid Dr. *Kerkring*, and to add hereafter ſome Reflections, that may ſeem neceſſary to remove the principal difficulties occurring in this matter.

But ſince the things to be ſaid do ſuppoſe ſome knowledge of the Parts, where theſe Eggs are formed and perfected, it will not be amiſs, beforehand to caſt your Eyes upon the *Figures* of Table II, of which the 1ſt repreſents a *Matrix* with its chief dependances: where

B. is the Matrix.

C. the Bladder of Urine, faſtned to the neck of the matrix.

D.D. the two teſticuli, *or rather the repoſitory's, which contain the Eggs ſpoken of.*

E.E. the two Tubes of the matrix.

F.F. the two vaſa deferentia, *eſteemed by Anatomiſts to convey* ſemen teſticulorum in uterum.

G. G. the two vaſa præparantia, *for preparing the matter, to be perfected in* teſticulis.

Fig. II. repreſents Eggs of different bigneſs, as Dr. *Kerkring* affirms to have found them in the teſticles of a Woman.

Fig. III. ſhews a bigger Egg, ſuch an one as we have found at *Paris* in a Woman of 40 years of age, and in thoſe of a Maid of 18 years.

Fig. IV. exhibits ſmaller Eggs, of which we have found a good number in the teſticles of a Cow.

Fig. V. repreſents an Egg, which D. *Kerkring* affirms to have opened three or four days after it was fallen into the *matrix* of a Woman, and in which he ſaw that little *embryon* marked *B*, whereof he found the Head begun to be diſtinguiſhed from the Body yet without a diſtinct preception of the organs.

Fig. VI. ſhews a bigger Egg, which D. *Kerkring* did open a fortnight after conception, finding in it theſe particulars;

A. a little Secondine.

B. B. B. B. the membrane, Corion, *divided in four places.*

C. C. C. C. the membrane, Amnios, *divided ſo too.*

D. the Navel-ſtring, by which the Child is faſtned to the Secondine.

E. a Child of 14 *days after Conception, in which the face begins to appear, together with the principal parts of the Body.*

Fig. VII. repreſents the *Sceleton* of an Infant, ſound by the ſame in one of theſe Eggs three weeks after Conception.

Fig. VIII. exhibits the *Sceleton* of an other Child, ſound alſo by him in an Egg, a moneth after Conception.

Fig. IX. repreſents the *Sceleton* of an *Embryon*, ſound by him in an Egg ſix weeks after Conception.

Though this Opinion (*ſaith Kerkringius*) about the firſt formation of Man in an Egg, as that of all Fowl, is not common, yet 'tis true; and if any find it difficult to believe, he may caſt his Eyes upon Fig. II. where he will ſee of thoſe Eggs repreſented after the life, as I have ſound them my ſelf in the body of many Women open'd by me.

Theſe Eggs are to be met with, not only in the teſticles of Women married, but alſo in thoſe of Maids, even as young Hens will lay Eggs without any commerce with a Cock.

Theſe Eggs are of the bigneſs of a pea, and they contain a glutinous liquor, which will be hardn'd by the fire, juſt as the White and Yolk in other Eggs. The taſt of them is flat and unpleaſant enough; they are inveſted with one or two fine skins, which ſtrech themſelves a little while after the Eggs are fallen into the Womb, and change into two membranes, called *Amnios* and *Chorion.* And as theſe two membranes are alwaies found afterwards, enwrapping the Child; ſo 'tis very probable, that the Eggs of Women are alſo cover'd with two skins from their beginning; though by reaſon of their fineneſs I could not diſtinctly ſee them.

It ſeems, that *Fallopius* hath ſeen theſe Eggs before me; as appears in his *Anatom. Obſervations.* And as to their Uſe they have in Generation, it ſeems eaſie to be determined, by reflecting on what that very expert Anatomiſt *Thomas Wharton* teacheth in his Treatiſe of *Glandulis* ch. 33. concerning the manner of Conception. For, according to him, *Semen Viri penetrat in teſtes fœminæ per uteri Tubas.* Now there it is joyned with the Egg, in ſuch a manner, which hath not been explained till now, but is never the leſs certain, and much reſembling to what comes to paſs in the other oviparous animals.

The Egg being made thus fecond, deſcends into the womb through the *vaſa deferentia*, and in two or three days grows of the bigneſs of a black Cherry. When they fall down, they are a little bigger than we have repreſented them; but being ſoft, they are eaſily flatned, and never remain round. If in falling they are handled and ſlightly preſſed, there will ſtick a little skin to the finger, which ſhews that 'tis not ſeed, nor any thing like it, but of ſuch Eggs, as we ſpeak of. *Fœminæ dejiciunt hæc Ova imprimis tempore menſtruorum, vel in Iræ vehementia.*

I have had (ſaith *Kerckringius*) an occaſion favorable enough for examining that *Germe* of three or at moſt four daies, repreſented *Fig.* V. A married Woman dyed 3 or 4 daies *poſt fluxum menſtruum.* I aſſiſted at the opening of her Body, and having found in the *matrix* a little round maſs of the bigneſs of a great black Cherry, I took the husband aſide, and asked him, *Num à tempore fluxus menſtruorum uxorem cognoviſſet?* And having received for anſwer, that he had, I pray'd him to let me carry home with me this little ball, which I had found in her womb. I was no ſooner come home but I open'd it, and found, that nature had wrought with ſo much activity in ſo ſmall a time, that one might already ſee the firſt lineaments of a Child, ſince we obſerved in it the head as diſtinct from the Body, and in the head we took notice of ſome traces of its principal organs. As for the reſt of the Body, it was nothing as yet but a maſſe groſly wrought, as you may ſee in this *Figure.*

But further, the *Embrio* repreſented in *Fig.* VI. was only of 15. daies, when in its Head there were noted the Eyes, Noſe, Mouth, and Ears; and the Body began to have Leggs and

Armes, as well diſtinguiſhable as appears in this *Figure*; which repreſents it juſt as it was given me. I durſt not yet attempt to ſeparate the Fleſh from theſe little Bones, or rather from theſe ſmall Cartilages, which in time become Bones; all theſe parts being yet too tender to make an accurate diſſection of them.

In *Figure* VII. is delineated a child, which is already furniſhed with all its Cartilages, though it had been conceived but three weeks. It being fallen into my hands, I attempted to ſever the skin and the fleſh from the Cartilages, holding the place of the Bones, and I ſucceeded well enough in it, and keep ſtill by me the *Sceleton* thereof, truly repreſented in this *Figure*. The Head, wherein the Brain is to lodge and all mans wiſdome, is nothing but a ſimple membrane inflated with wind or Spirits. The Armes are diſtinct from the Body, and the Hands have now their fingers perfectly diſtinct. One may eaſily count in this contexture of Cartilages, how many Ribbs there will be. And laſtly the diſtinction of the Toes of the Feet is as perceptible, as that of the fingers of the Hands. But we muſt add withall, that all theſe parts are no longer then hairs, and conſequently a great dexterity and niceneſs is to be uſed for diſplaying them.

Figure VIII. repreſents a *fœtus* of a moneth, having now the whole humane ſhape, and the Bones thereof firm enough in many places to ſupport the parts. Behold the Figure well, which repreſents this litle Engin in its natural ſize. It already in a manner ſuſtains it ſelf. The two Jaw-bones appear; the clavicles are formed; and all the Ribbs are very diſtinct, except the firſt and laſt; which are not wont to have, even in the *Second* moneth, the conſiſtence of Bones. One may ſee in the Armes the Joynts of the Shoulder-bones and of the Elbows; as alſo the Thighs and both the Leggs, together with their bones, called *Focils*; which I had not obſerved, when I wrote my treatiſe of the *Generation of the Bones*. All what you ſee of white in this *eight* figure, hath at this time the quality of bones. Where I have a fair occaſion to enlarge and to diſcuſs that great queſtion, whence proceeds the hardneſs in Bones? And I could not give a better, nor a more curious reaſon for it, than by alledging the doctrine, that ſerveth for a ground to all Chymiſtry;

miſtry; which is that there is an *Acid Spirit*, univerſally diffuſed through the world, which giveth ſolidity not only to Bones, but alſo Minerals and Mettals, and to all Vegetables; penetrating all, fixing all, and being the Father of the Hardneſs and Solidity in all bodies.

Fig. IX. repreſents a Child of ſix weeks after Conception: where it is to be noted, that comparing together the Bones of divers fœtus's it will be found, perhaps to admiration, that that which have been conceived but a little time after another, hath yet the bones in proportion twice as big. That which is here exhibited by Fig. IX. appears much leſſer than an other of two months, as appears in my Book of the *Generation of Bones*; but the Bones are for all that no leſs remarquable: for whatever hath the hardneſs and conſiſtence of Bones in *that*, hath already the nature of Cartilages in *this*. The inferior jaw-bone is moſt obſervable in this Child of 6. weeks, marked A, it being at this age compoſed of ſix little bones, which when it is born are all joyned together, and make but one.

If it be asked, How I come to know, that theſe degrees of growth come to paſs exactly within thoſe times recited; eſpecially ſince in abortions we often ſee *Embrio's* of 4 moneths and above, that are not ſo big as thoſe ſpoken of? I might anſwer by repeating all I ſaid before, when I compared the proportions of thoſe different Germes. To which I ſhall only add, that *Embrio's* which miſcarry have often remain'd a long while in the Body before they came forth, or have lived there ſo ſickly as not to draw perhaps half the nouriſhment, neceſſary for them, and therefore much leſs than elſe they would be.

So far Kerkringius; on whoſe diſcourſe are made theſe Reflexions by Monſieur *Denys*.

1. That thoſe Eggs are generated in *Fæminarum teſticulis*, and thence made to deſcend *per tubam* into the matrix, *in coitu*, *per vim ſpirituoſam ſeminis maſculi*, *per uteri tubam penetrantis*.

2. That thoſe Eggs are of different bigneſſes; ſince theſe of the third Fig. repreſent one according to the life, as it

was ſound with 9, or 10 leſſer ones in a woman of 40 years of ge. Such as were found by him in the teſticles of a Cow, are duly exhibited in Fig. fourth. If any do wonder, that in ſo big an animal they ſhould be ſo much ſmaller then in a Woman; he will have more cauſe to admire, that Women have them ſo little in compariſon of thoſe of Ducks, Hens, &c. the firſt beginnings of things not bearing alwaies a proportion to their ſtate of encreaſe; as Beanes and Peas (*e. g.*) whence grow plants but of a very midling ſize, are much bigger ſeeds, than the kernels of Apples and Pears, which do produce conſiderably big Trees. Beſides, it may be, that Cowes, when in their heat, may afford bigger Eggs. Mean time the reaſon why the Eggs of Fowl are alwaies proportionably bigger than thoſe of Women and of Quadrupeds, is, that they, when laid, muſt contain the matter not only for forming, but alſo for feeding the young animal.

3. That this Opinion is not ſo new, as ſome imagine; ſince *Fallopius* in Obſerv. Anatom. *Bartol.* Anat. reform. l. 1. c. 26. *Riolan.* Ench. anat. l. 2. c. 37. *Laurent.* Anat. l. 7. c. 10. make mention of them.

But here we ſhall obſerve the *True ſtate of the Queſtion* out of the *Journal* of Monſieur *Gaulois*, ſaying, that the veſicles or Eggs in all ſorts of femals, are to be conſidered in three conditions: 1. When they are faſtn'd to the place where nature hath lodg'd them as in a repoſitory. 2. When they are looſn'd from thence. 3. When they encloſe the *Embrion*. The firſt of theſe, namely, that there are veſicles in all ſorts of Femals, faſtn'd to their Bodies, is certain, and not new; as appears by the Authors juſt now quoted. It is alſo certain, that after conception, that which encloſeth the *Fœtus*, is almoſt like an Egg; but this is not new neither, ſeeing that *Hippocrates* hath obſerved it lib. *de natura puer;* and *Ariſtotle* hath ſaid it more than once, viz. l. 7. hiſt. Anim. c. 7. and l. 3. de gener. Anim. c. 9. To which alſo the moderns agree and amongſt others the famous *Harvey* Exper. 68. de gener. Anim. The *Queſtion* therefore is only, Whether theſe Veſicles, faſtn'd to the body of Femals, are looſn'd from it; and whether that kind of Eggs, wherein the *Embrion* is form'd, is one of the veſicles

looſned?

looſn'd? And here *Kerkringius* aſſerts the affirmative; as hath been ſeen above. Thoſe that are of the contrary Opinion, ſay, that it is ſure, that that bladder, like an Egg, in which the *fætus* is form'd, coms not from elſewhere; ſince 'tis known, that it is produced in the place of conception, and even how it is there produced; as appears out of *Harvey*, ibid. & tract. de Concept. Beſides, *ſay they*, the veſicles found in the body of Women, are ſo faſtn'd there, that naturally they cannot be ſeparated from thence; and ſuppoſ'd they were looſn'd, there is in the ſame place, where they are, no paſſage large enough to get through. They add, that if you will give the name of Eggs to all the veſicles, to be found in the parts of Generation, there would alſo be Eggs in the body of Men, it being known, that at the ſide of the *vaſa deferentia* there are found divers veſicles, which *Anatomiſts* compare to a Cluſter of Grapes by reaſon of their figure.

The Reader, ſaith this *Journaliſt*, is left to decide this Queſtion. He only intimates, that in the many Animals, diſſected in the Royal Philoſophical Academie at *Paris* there were never found any veſicles actually looſe. But that, as to a paſſage for them, there had been, 3 years ſince, diſſected a Woman, and found in each of the *tubæ uteri* a manifeſt cavity going into the bottom of the *matrix*: Adding, that though theſe conduits appear not open ordinarily, they may yet dilate themſelves at the time of Conception: As the conduit, through which the Eggs of the Fowl do paſs out of the *ovarium* into the *matrix*, is uſually very cloſe; but yet opens ſometimes.

4. To return to M. *Denys*, he obſerveth, that all other animate creatures (not to ſpeak now of Plants) are produced by the meanes of Eggs; as Birds, Inſects of all ſorts, Fiſhes (of which laſt ſort though Whales, Sea-Calves and Dolphins bring forth live creatures of their kind, yet they firſt breed them within their Bodies in Eggs:) And why not Quadrupeds alſo and the Femals of Mankind?

5. As for Eggs, ſaid by *Kerkringius* to have been found in *Virginibus*, the ſame M. *Denys* eſteems that probable enough. For, *ſaith he*, though we had not the Inſtance of Hens, lay-

ing Eggs without any congreſs of a Cock; the place where they are bred ſhews enough, that Man contributes nothing to their production; all that he can do, being nothing but an attraction of the Eggs out of their Conſervatory, and the making them deſcend into the *uterus*, *ut ibi irrorentur à ſemine, & fœcunditatem acquirant;* even as the Juices of the Earth do vivifie all the Plants by inſinuating themſelves into the grains, and penetrating their skins. And it may be, it is the alteration that befalls theſe Eggs, when they are retained too long, which cauſeth the abundance of Vapors and diſorders, which other parts are accuſed of. On which occaſion he alledgeth a notable example of a young Maid of quality, that lately died in the 18*th* year of her age; who was ſubject to very frequent Hyſterical fits of vapors, of which ſhe was one day aſſaulted with ſo great violence, that it coſt her her life. Her Body being opened, *Teſticulus dexter erat flaccidus, & figuræ ſolitæ; at ſiniſter adeò tumidus & inflatus, ut Ovi Anatis æquaret magnitudinem: Eoque aperto, Ovum fuit intus repertum, Olivam figurâ & magnitudine referens, & ſeparatu nequaquam difficile.* This, *he ſaith*, is ſtill kept by Monſieur *Charas*.

N. B. Since theſe particulars were ſent to the *Preſs*, there came to the Publiſhers hands the very lately printed Book of that diligent and expert Anatomiſt *Regnerus de Graaf*, intituled *Tractatus novus de Mulierum Organis generationi inſervientibus*; in which the above-recited difficulties, moved by M. *Gaulois*, and others alſo, are amply taken notice of, and ingeniouſly ſolved: Concerning which, we may by the next opportunity give the Curious Reader a fuller accompt; as alſo, wherein the ſaid *De Graaf* differs from *Kerkringius*, in this matter, which, for want of time, could not be done at preſent.

Tab. II.

Fig. V.

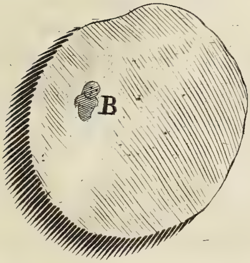


Fig. I.

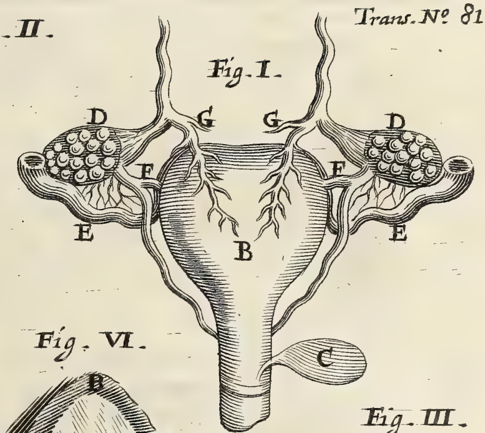


Fig. VI.

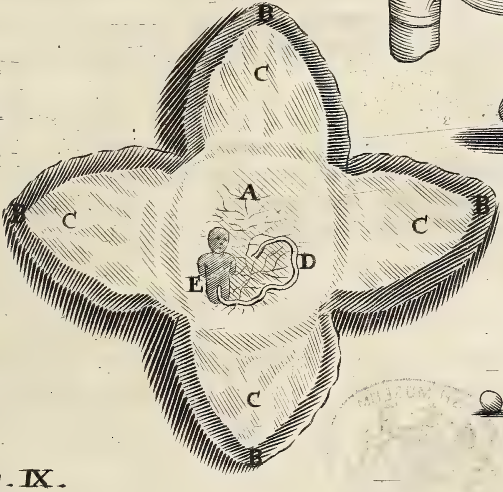


Fig. II.

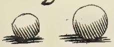


Fig. III.

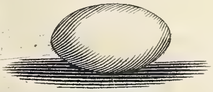


Fig. IV.

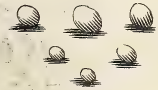


Fig. IX.

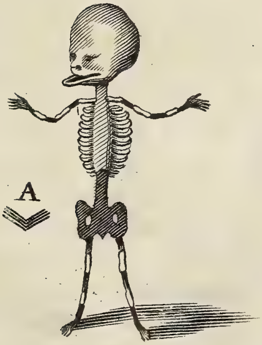


Fig. VIII.

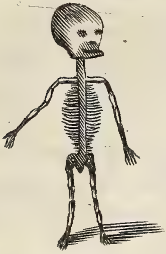
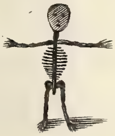


Fig. VII.



BRITISH MUSEUM NATURAL HISTORY

An Accompt of ſome Books.

I. *PLANTARVM VMBELLIFERARVM Diſtributio nova per Tabulas COGNATIONIS & AFFINITATIS ex Libro Naturæ obſervata & detecta ; A.* Rob. Moriſon *Med. & Prof. Botan. Regio, &c. Oxonii è Theatro Sheldoniano,* 1672. *To be ſold by* John Martyn *at the Bell in St. Pauls Church-yard.*

THis Excellent Botaniſt, having with indefatigable induſtry ard uncommon ſagacity obſerved and diſcovered out of the Book of Nature a general and genuine Method, reducing all Vegetables to certain infallible *Claſſes* or Heads, by Tables of Affinity or Cognation ; hath in this Book given an *Eſſay* of the ſame, by reducing that Family of Plants, commonly called *Umbells*, to their ſubaltern kinds, from the different Shape and Form of their *Seeds* : Intending, if he do further meet with ſuitable encouragement and aſſiſtance, to publiſh the whole Method and Work, in a manner lying ready by him, and tending ſo much to the advancement of a vaſt part of Natural Hiſtory.

This *Specimen*, being but the *thirtieth* part of the whole, firſt aſſigneth very ſuccinctly to the *Umbelliferous* Plants that common Character, wherein they all agree amongſt themſelves, and are differenced from all other families ; and then reckons up their ſeveral, both intermediat and ultimat, ſpecies'*s*, together with their reſpective ſubordinate and characterical diſcriminations. By which way the Students of Botanicks will henceforth be able to learn from Nature it ſelf, with much order, clearneſs, and eaſe of memory, all ſorts of Plants by their ſupreme *genus*'s, intermediat kinds, and loweſt *ſpecies*'s, and their particular varieties ; without a tedious peruſal of voluminous Books, and an irkſome expence of Time.

And as this Experienced Author taketh the *Generical* and Eſſential marks of Plants from their *Seeds* ; ſo he taketh the *Specifical* differences of their ſeveral particular families under one common Head from their leſs noble parts, as the Root, Leaf, Flower, Stem, Scent, Taſt, and Colour.

The Reader then will in this *Eſſay* find performed theſe five things: Firſt, a *Generick* Note both of the higheſt and ſubaltern genus'*s* of the *Umbells*. Secondly, a ſpecifical mark proper for each *ſpecies*. Thirdly, the duration of every *ſpecies*, whether annual or perennial. Fourthly, the Place of their growth, together with their peculiar temperament, vertues, and names. Fifthly, the Authors animadverſions on the errors and miſtakes of *C. Bauhinus*, and other Authors, that have written on this argument.

The whole adorned and illuſtrated with very curious and exceedingly accurat *Cuts*, furniſh't at the charge of ſeveral of the Generous and Learned members of the Famous Univerſity of *Oxford*, and engraven by that rare Artiſt Mr. *Loggan*.

N.B. Since the writing of this Accompt concerning this uſefull work, we are informed by the Author thereof, that he already findeth ſo much encouragement for the proſecution thereof, that he little doubts, but that about the end of this preſent Year he ſhall have finiſh't in the ſame Preſs, where this beginning was made, at leaſt five or ſix *Sections* more, which ſhall be,

1. *Legumina & Trifolia.*
2. *Frumenta & Gramina.*
3. *Plantæ Stellatæ*, *lacteſcentes & papposæ*; *lacteſcentes & non papposæ*; *papposæ & non lacteſcentes.*
4. *Triquetræ*, *bicapſulares*, *& mollientes.*
5. *Corymbiferæ.*
6. *Galeatæ & Verticillatæ.*

II. ΛΟΙΜΟΛΟΓΙ'Α, *ſive PESTIS nuperæ* Londini *graſſantis Narratio Hiſtorica. Auth.* Nathan. Hodges *M.D. &c.*

THe Author of this Book, having kept his ſtation as Phyſitian in the City of *London* during the laſt Plague, maketh it his buſineſs to give us here an Hiſtorical Account of what he then obſerved and practiſed in this fatal Diſtemper; which he doth in 8 Sections.

In the *Firſt* he declareth the Original and Progreſs of this *London-Plague.*

In the *Second* he delivers his Opinion about the principal *Cauſe* of the Peſtilence in general; which he conceiveth to be a very ſubtile Nitrous Spirit, breathed out of the Earth into the Air, and by the Air conveyed into our Bodies, and thence by contagious ſteams diffuſed and communicated to others. Where he alſo diſcourſes of the noxiouſneſs of eating the fleſh of Cattle that dyed of themſelves, as cauſing a great Cachexy in the body of man, and exceedingly diſpoſing it to take the Plague: adding withall the difference, there is between the Contagion in Cattle from that in Men; which he maketh to be not in kind, but in degree only.

In the *third* he examins the primary Seat of the Plague, and eſteems that to be the *Spirits*, whence 'tis tranſmitted into the Body and *Viſcera*, infected by their influx.

In the *fourth* he conſiders the Affinity between the *Plague* and *Scorbute*, and ſaith, that theſe two do frequently coaleſce into one, becauſe of their agreement in a Salin principle. Where he alſo takes notice of divers odd inſtances of diſeaſes, as the *Conſumption* and the *Kings Evill*, which upon the Plague ſupervening were cured, the perſons ſurviving; As alſo of ſome *Podagrical* people, that happening to be ſeized by the Plague, loſt the Gout, and recover'd of the Plague too.

In the *fifth*, he diſcourſes of the manifeſt ſigns of the Plague, as well of thoſe of its firſt Invaſion, as thoſe that immediately enſue upon the ſame; among which he reckons a Fever as a common, yet not inſeparable ſign; a palpitation of the Heart; (which he hath obſerved to be ſometimes ſo ſtrong and loud, that it may be heard at a conſiderable diſtance:) item Blains, Bubo's, Carbuncles, Tokens, &c. Where he animadverteth upon the opinion of Doctor *Diemerbrook*, importing, that *Bubo's* are produced by an occurſion of a ſalin and acid humor, making an ebullition, as when Spirit of vitriol is poured on Salt of Tartar. In the examination of *Carbuncles* he inquires, How in the human Body can be generated ſo ſharp and cauſtick an humor, as is that in Carbuncles; and alſo, how Nature comes to ſeparate it from other liquors. Where he reflects again upon the aſſertion of the lately mentioned *Diemerbrook*, who makes a peſtilential Carbuncle nothing but a Gangrene *in fieri*; and obſerveth withall, that thoſe Carbuncles will appear in every part of the Body, he having ſeen one upon a Womans breaſt preſently after ſhe had been delivered of a Child; which ſucked her during her diſtemper without any inconvenience; the Mother her ſelf recovering alſo ſoon after. Further, he takes notice of the peſtilential *Tokens* as certain meſſengers of Death: where he relates ſome Examples of perſons, in whom they came out without any trouble to the Body, but yet killed them afterwards. Here he gives notice, that ſome wicked and crafty Nurſes, to hide the *Tokens* in dead Bodies, do cover them preſently after death with moiſt linnen ſheets; whereby the fermentation of the venenat humors being quelled, and the pores cloſed, the Searchers may be deceived, and ſo not cauſe the Houſe to be ſhut up.

In the *ſixth* he treats of the *Prognoſticks* of an Imminent Plague; among which he reckons chiefly the change of Chronical diſeaſes into Acute ones with violent Symptoms; and a great Murrain among Cattle. Here he noteth, that a Plague very cruel at firſt, is of ſhort duration; as alſo, that what time it taketh from its Beginning to its Hight, the ſame it taketh from its hight to its Period. Beſides, he obſerves the Preſages of Death to be, an Hemorrhagy, *Fluxus menſtruæ*, a Looſneſs, a Dyſentery, green or black Excrements. He alſo taketh notice, *that* weak Lungs do not eſcape; *that* the firſt Sweats coming without eaſe to the Patiens; a long nauſeouſneſs, and the ſubſiding of *Bubo's* without ſweat; ill-coloured and blackiſh ſwelling, &c are fatal; and that *Carbuncles* are worſe than *Bubo's*. From the *Urine* he eſteems no certain prognoſticks can be made, ſince commonly it appears as good in the Plague, as that of healthy perſons. And the *Pulſe* he counts in this diſtemper a very uncertain and fallacious ſign.

The *ſeventh* delivers his Method of Curing, which he placeth both in the Encouragement of the Patient, and in the Uſe of Generous medicins; without venæ-ſection, and (unleſs in the caſe of a ſurfet and a foul ſtomach,) without vomiting and purging; here being requiſite a Separation rather than an Evacuation, and the Seat of this Diſeaſe being not in the Juices of the Body, but in the Spirits.

Of *Antidotes*, the principal means of Cure, he ſpecifies thoſe which he conſiders as ſome of the choiceſt, taken from Vegetables as well, as Animals and Minerals. And here he expreſſeth a particular value for Ginger, both in powder for ſweating, and in Confit for preventing; as alſo for the *Bezoardicum Minerale*: But *Bezoar* and *Unicorns Horn* he eſteems of greater price than vertue. He commends *Spirit of Hartshorn*, as an excellent Diaphoretick. He particularly deſcribeth thoſe, which he chiefly made uſe of with good ſucceſs, from the preſcriptions of the *Colledge* , and of Sr.*Theod. Mayern.*This part he concludeth with his method as to the regiment of Life,and his way of treating all ſorts of peſtilential Tumors.

In the *Eighth* and laſt he diſcourſeth of the means preventing the Plague;of which he conſiders *ſome* to be *General*,and thoſe *both* of *Nature*, as ſtrong Northerly winds;*and* of Art,as great Guns diſcharged morning and evening, as alſo appropriat perfumes, by burning reſinous,but not ſweet-ſcented,wood.Other means are, *particular* Amulets ; concerning which the Reader may conſult the Author himſelf.

To the whole is annexed an Account of the regiment of life,which the Author himſelf uſed ; as alſo a *Liſt* of thoſe that dyed of the Plague this year,which amounted to 68596. beſides 29000. that died of other diſeaſes during that time.

III.*A Philoſophical Eſſay,declaring the probable* CAVSES *of* STONES *in the Greater World,in order to find out the Cauſes and Cure of the* Stone *in the* Kidneys *and* Bladder *of Men : by D.*Thomas Sherley,*Phyſitian in Ordinary to his Majeſty,*Londini *in* 8o.

THe Ingenious Author of this Eſſay having propoſed to himſelf to publiſh a Medicinal Tract concerning the moſt probable Cauſe of the Stone in the Bodies of Animals, found it neceſſary to premiſe this Inquiry into the Cauſes and Nature of Petrefaction in the greater World in general;to ſee,whether the Cauſes be not the ſame in both, or at leaſt bear not ſome analogy or reſemblance to one another.

In the doing of which,he thought good to relate a number of ſelect Hiſtories of Petrifications, and then to examine the cauſes by which they were performed.In which latter part,having waved the *Ariſtotelian* doctrine of this point,nor found a full ſatisfaction in that of the vulgar *Chymiſts*;he cloſeth with that ancient *Hypotheſis*,which imports, that Stones and all other Sublunary Bodies are made of *Water* condenſed by the power of *Seeds*,which by the vertue of their fermentive Odours perform theſe tranſmutations upon Matter. For the better underſtanding of which,he premiſes ſome Generals,and then deſcends to particular proofs of what he aſſerts: concerning which we can do no better than to remit the Reader to the Author himſelf.

IV.*Caroli Claromontii M.D. &c.de* AERE,SOLO,*&* AQVIS *Angliæ; deque* MORBIS *Anglorum vernaculis Diſſertatio: Nec non Obſervationes Medicæ* CAMBRO-BRITANNICÆ. Londini *Impenſis* Joh.Martyn,*ſub ſigno Campanæ in Cœmeterio D.Pauli*,1672. *in* 12o.

THe Author of theſe two Tracts,endeavours in the *one*, to give an account of the Scituation, Air, Soyl,and Waters of *England*;as alſo of the Temper,Dyet, Exerciſes, and chief Sickneſſes of the Inhabitants thereof : In the *other*,he maketh it his buſineſs to deliver ſeveral Hiſtories of Diſeaſes, to the number of 26, managed by himſelf in *Wales*; which he doth,by deſcribing the nature of each of thoſe Maladies,by adding his ratiocinations thereon,by giving their Indications, and ſhewing his Method of Cures,together with the Events of them.

ERRATA in this *Numb.p.*4006.*l.*2.after theſe words,2 *foot long*,add;*which did repreſent the ſaid Crown of no greater bigneſs than you ſee* Fig.3.in *Tab.*1 *p.*4012.*l.*8.*r.flexûs.p.*4020.*l.*1.*r.perception.p.*4022.*l.*19.*r.no bigger.*

LONDON, Printed for *John Martyn* Printer to the *Royal-Society.* 1672.

Numb.82.

PHILOSOPHICAL TRANSACTIONS.

April 22. 1672.

The CONTENTS.

Mr. Newtons *further ſuggeſtions about his Reflecting Teleſcope; together with his Table of* Apertures *and* Charges *for the ſeveral* Lengths *of that Inſtrument. An Anſwer of the ſame to ſome Objections made by a French Philoſopher againſt the ſaid Teleſcope. Some Obſervations of* Jupiter's *Tranſit near two Fix't Stars; made by* Mr. Flamſtead. *A Relation of the Return of a great Permanent Spot in the Planet* Jupiter, *obſerved by Signor* Caſſini; *together with an intimation of the Vſefulneſs of that Diſcovery. Obſervations of a* New Comet, *made at* Paris *by the ſame. An Accompt of ſome Books:* I. *De RESISTENTIA SOLIDORVM,* Alex Marchetti. II. *A Table of Ten thouſand SQVARE NVMBERS, and of their SIDES or ROOTS, &c.* III. *Regneri de Graaf de MVLIERVM ORGANIS GENERATIONI INSERVIENTIBVS Tractatus novus.* IV. *Diſcours de la CONOISSANCE des BESTES, par le* P. Pardies.

Mr. Newton's *Letter to the Publiſher of* March 26. 1672. *containing ſome more ſuggeſtions about his* New Teleſcope, *and a* Table *of* Apertures *and* Charges *for the ſeveral* Lengths *of that Inſtrument.*

SIR,

SInce my laſt Letter I have further compared the two Teleſcopes, and find that of Metal to repreſent as well the Moon,as neerer Objects, ſomething diſtincter than the other. But I muſt tell you alſo,that I am not very well aſſured of the goodneſs of that other, which I borrowed to make the Compariſon;and therefore deſire,that the other Experiment ſhould be rather confided in, of reading at the diſtance of between a 100 and 120 foot, at which I and others could read with it in the *Tranſactions*, as I found by meaſure : At which time the aperture was $1\frac{1}{3}$ of an Inch ; which I knew by trying, that an obſtacle of that breadth was requiſite to intercept all the light, which came from one point of the object.

I ſhould tell you alſo, that the little plain piece of metall, next the eye-glaſs, is not truly figured: whereby it happens, that objects are not ſo diſtinct at the middle as at the edges. And I hope, that by correcting its figure, (in which I find more difficulty than one would expect,) they will appear all over diſtinct, and diſtincter in the middle than at the edges. And I doubt not but that the performances will then be greater.

But yet I find,that there is more light loſt by reflection of the metall which I have hitherto uſed, than by tranſmiſſion through glaſſes: for which reaſon a ſhallower charge would probably do better for obſcure objects ; ſuppoſe ſuch an one, as would make it magnifie 34 or 32 times. But for bright objects at any diſtance, it ſeems capable of magnifying 38 or 40 times with ſufficient diſtinctneſs. And for all objects, the ſame Charge, I believe, may with advantage be allowed, if the ſteely matter, imployed at *London*, be more ſtrongly reflective than this which I have uſed.

The performances of one of theſe Inſtruments of any length being known, it will appear by this following *Table*, what may be expected from thoſe of other Lengths by this way, if Art can accompliſh what is promiſed by the Theory. In the *firſt* Column is expreſſed the Length of the Teleſcope in feet; which doubled gives the ſemidiameter of the Sphere, on which the concave metall is to be ground. In the *ſecond* column are the proportions of the Apertures for thoſe ſeveral Lengths. And in the *third* column are the Proportions of the *Charges*, or diameter of the ſpheres, on which the convex ſuperficies of the eye-glaſſes are to be ground.

Lengths.	*Apertures.*	*Charges.*
$\frac{1}{2}$	100	100
1	168	119
2	283	141
3	383	157
4	476	168
5	562	178
6	645	186
8	800	200
10	946	211
12	1084	221
16	1345	238
20	1591	254
24	1824	263

The uſe of this Table will beſt appear by example: Suppoſe therefore a half foot Teleſcope may diſtinctly magnifie 30 times with an inch Aperture, and it being required to know, what ought to be the analogous conſtitution and performance of a four foot Teleſcope: By the ſecond column, as 100 to 476; ſo are the Apertures, as alſo the number of times which they magnifie. And conſequently ſince the half foot Tube hath an inch aperture and magnifieth 30 times; a four foot Tube proportionally ſhould have 4$\frac{76}{100}$ inches aperture, and magnifie 143 times. And by the third column, as 100 to 168; ſo are their Charges: And therefore if the diameter of the convexity of the eye-glaſs for a half foot Teleſcope be $\frac{1}{5}$ of an inch, that for a four foot ſhould be $\frac{168}{500}$, that is, about $\frac{1}{3}$ of an inch.

In like manner, if a half foot Teleſcope may diſtinctly magnifie 36 times with $1\frac{1}{4}$ of an Inch Aperture; a four foot Teleſcope ſhould with equal diſtinctneſs magnifie 171 times with 6 inches Aperture; and one of ſix foot ſhould magnifie 232 times with $8\frac{2}{3}$ inches Aperture; and ſo of other lengths. But what the event will really be, we muſt wait to ſee determined by experience. Only this I thought fit to inſinuate, that they which intend to make trials in other lengths, may more readily know how to deſign their Inſtruments. Thus for a four foot Tube, ſince the Aperture ſhould be 5 or 6 inches, there will be required a piece of metal 7 or 8 inches broad at leaſt, becauſe the figure will ſcarcely be true to the edges. And the thickneſs of the metal muſt be proportional to the breadth, leaſt it bend in the grinding. The metalls being poliſhed, there may be tryals made with ſeveral eye-glaſſes, to find, what Charge may with beſt advantage be made uſe of.

An Extract of another Letter of the ſame to the Publiſher, dated March 30. 1672. *by way of Anſwer to ſome Objections, made by an Ingenious French Philoſopher to the New Reflecting Teleſcope.*

SIR,

I Doubt not but *M. A.* will allow the advantage of reflexion in the Theory to be very great, when he ſhall have informed himſelf of the different *Refrangibility* of the ſeveral rays of light. And for the practique part, it is in ſome meaſure manifeſt by the Inſtruments already made, to what degree of vivacity and brightneſs a metaline ſubſtance may be poliſhed. Nor is it improbable but that there may be new ways of poliſhing found out for metal, which will far excell thoſe that are yet in uſe. And when a metal is once well poliſhed, it will be a long while preſerved from tarniſhing, if diligence be uſed to keep it dry and cloſe, ſhut up from Air: For the principal cauſe of tarniſhing ſeems to be, the condenſing of moiſture on its poliſhed ſurface, which by an Acid ſpirit, wherewith the Atmoſphere is impregnated, corrodes and ruſts it; or at leaſt, at its exhaling, leaves it covered over with a thin skin, conſiſting partly of an earthly ſediment of that moiſture, and partly of the duſt, which flying to and fro in the Air had ſetled and adhered to it.

When there is not occaſion to make frequent uſe of the inſtrument, there may be other waies to preſerve the metal for a long time; as perhaps by immerging it in Spirit of wine or ſome other convenient liquor. And if they chance to tarniſh; yet their poliſh may be recovered by rubbing them with a ſoft piece of leather, or other tender ſubſtance, without the aſſiſtance of any fretting powders, unleſs they happen to be ruſty: for then they muſt be new poliſhed.

I am very ſenſible, that metal reflects leſs light than glaſs tranſmits; and for that inconvenience, I gave you a remedy in my laſt Letter, by aſſigning a ſhallower charge in proportion to the Aperture, than is uſed in other Teleſcopes. But, as I have found ſome metaline ſubſtances to be more ſtrongly reflective, and to poliſh better, and be freer from tarniſhing than others; ſo I hope there may in time be found out ſome ſubſtance much freer from theſe inconveniences, than any yet known.

Obſervationes JOVIS ad duas Fixas tranſeuntis, *Derbiæ* Anglorum habitæ menſibus Febr. & Martii A. 16$\frac{71}{72}$. ſt. veteri à *Joh. Flamſtead.*

—M*Itto Tibi duos* Jovis *tranſitus, accuratè, ni faller admodùm, obſervatos, poſteriorem inprimis; adeò ut (abſit dicto jactantia) paucas, inter obſervationes hactenus factas, hiſce æquiparandas crediderim. Impertiri eas poteris quibuſcunque volueris. Invenies utique,* Rudolphina *loca* Jovis *magis errare quàm* Carolina*: qua de re Clariſſimum* Hevelium, *qui Tabulas iſtas omnium quæ extant optimas arbitratur, moneri velim.*

Martii 19. *&* 27. *noviſſimis, aliquot habebam Obſervationes maximæ elongationis quarti Satellitis à* Jove, *eamque deprehendi (minimùm)* 24½ *ſemi-diametros Jovis ab ipſo Jove, vel* 24¼ *juxta Generoſum & Doctum* Townlejum; *non verò* 23, *ut Dn.* Caſſinus *autumat. Ex eo tempore obſervare ulteriùs, ob lentem meam objectivam caſu vitiatam, non licuit.*

Sequuntur Obſervationes ipſæ.

AD Jovis *loca & latitudines in Ephemeridibus* Heckeri *conſignata advertens, comperui, ipſum cum Fixa Lucis* 4^{a} *(cujus latitudo* 1°.40'. *Bor. locus* mihi ♍ 14°. 7'. 16"; *at* Streetio, 14°. 3'. 54". *) junctum, ire ſecundùm longitudinem,* Febr. 13. *h.* 6. *p. m. ſed cum latitudine minori* 11". *Mecum propterea conſtituebam, ad hunc Tranſitum attendere. At nubes & pluvioſæ noctes obſervationem diſtulêre ad* ——

16. Februarii, *quo die, cælo ſatis ſerenante, ad obſervationem me accinxi, & h.* 7. 44'½, *alto* ♃ 18°. 10', *ejus à Fixa diſtantiam Tubo longiori dimenſus ſum,* 16'. 33". *& differentiam altitudinum centrorum* ♃^{ii} *&* ✱^{æ}, 1'. 1". *nocte ſequente.*

17. Febr. *h.*7. 25'. *p. m. alto* ♃ 15°. 54'. *ipſe à Fixa diſtitit* 50"; *altitudinum differentia erat* 8'. 40". *Eâdem nocte, h.* 8.59'. *vel forſan* 1. *min. maturiùs, Satelles primus ad dextram* ♃^{is}, *in ipſius umbram incidit, adeo tamen evaneſcentis exigua erat à limbo diſtantia, ut quanta fuerit dijudicare non potuerim.*

18. Febr. *h.* 7. 0'. *Fixæ diſtantia à centro* ♃^{is} *erat* 28'. 15"; *altitudinum differentia circ.* 15'. 29". *In utraque obſervatione Erro altior erat Fixâ, à qua ſemper Meridianum versùs ſtetit.*

Inito dein calculo ad dies ſingulos & horas Obſervationum, inveſtigavi

	d. h. ′	d. h. ′	d. ′ ″
Februar.	16. 7.44½	17 7. 25	18. 7. 0.
	° ′ ′	° ′ ′	° ′ ″
Jovis à Fixa longitudinem in Antecedentia	0. 9.16	0.17.22.	0.25.12.
Latitudinem ad Auſtrum ab ea	0.13.30	0.13.14.	0 12.45.
Ergo ♃^{is} *Latitudo Borealis* ——— ——	1 26.30.	1.26.46.	1.27.15.
Locus verus ——— { *Mihi* ♍	13.58. 0.	13.49.54.	13.42. 4.
Locus verus ——— { Streetio	13.54.38.	13.46.32	13.38.42.
Locus Jovis è Tabulis Streetii *Carolinis* ♍	13.48 39.	. . .	13 32.59.
Latitudo vera Borealis ——— ———	1.29.31.	. . .	1.29.40.

At in Ephemeridibus Heckeri *locus Jovis* ♍ 13°.45′. *latitudo* 1°.29′+, *ita ut totis* 13′. *in longitudine à cælo diſſideant*; *dum Authori* Carolino (*ſuo Fixæ conceſſo loco*) *error non ultra* 6′. *excedat*: *Uterque verò* (*minimum*) 2′. 25″, *ne dicam* 3′. *erret in Latitudine.*

Martii 15. (*ſt. v.*) *veſperi, obſervare cœpi* Jovis *diſtantias & poſitiones à Stella* ♌ 38, *cujus latitudo* 1°. 20′½ *Bor*. *Locus* Streetio ♍ 9°. 54′. 0″; *mihi verò* ♍ 9°. 57′. 20″. *hor.* 7. 25′. *p. m. alto* ♃ 32°. 52′. *Diſtantia centri ipſius ab ipſa* 33′. 50″. *Altitudinum differentia circit.* 20′. 42″.

Mart. 16. *h.* 7. 48′. *alta fixa* 36°. *Jovis ab ea diſtantia erat* 27′. 7″. *Altitudo minor* 16′. 3″.

Noctibus Martii 17. & 18. *ob nubes & ventos intermiſſæ obſervationes.*

Mart. 19. *varias habui, nec inaccuratas. Alto* ♃ 49°. 35′. *i. e. h.* 6. 45′, *Fixa altior erat quàm Planeta* 2′. 24″; *à quo h.* 6. 55′. *diſtitit* 10′. 21″. *Hor.* 4. 11′. *limbus Planetæ remotiſſimus à Satellite* 4to, *in maxima ferè elongatione ſito, diſtabat* 9′. 37″. *Satelles idem à Fixa*, 7′. 28″. *Interim Satelles primus ad limbum* ♃^{is} *appropinquabat, cui h.* 7. 51′. *jungebatur. Etiamnum* Erro *ſemper altior* apparuit, *ſed verè fuit depreſſior quàm* Fixa: *poſtea humilior* viſus *eſt, ſed reverâ fuit altior.*

Mart. 20. *melius præparato ad Altitudinum differentias capiendas Micrometro, Obſervationes habui* (*ſic putem*) *accuratiſſimas, quæ ſequuntur.*

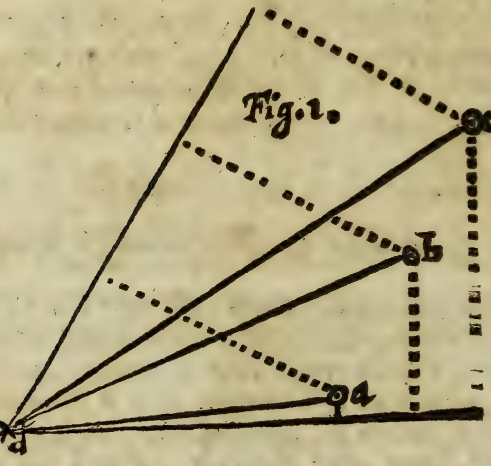
♃ *alto*	*h.* ′		′ ″
30. 0.	6.44½.	*Jovis centrum verè altius erat Stellâ* ——— ———	2. 13.
30.47.	6.51.	*Altitudinum eadem differentia rurſus capta* ——	2. 14.
32. 0.	6.59.	*Jovis centrum à Fixa diſtitit* —— ——— ———	7. 0.
38.30.	7.54$^{2}_{+}$.	*Centrum Jovis verè altius Fixâ* ——— ——— ——	3. 14.
40.50.	8.18⅔.	*Altitudinum differentia denuo capta* ——— ———	3. 42.
		Et deinde Centrorum diſtantia erat ——— ———	7. 5.

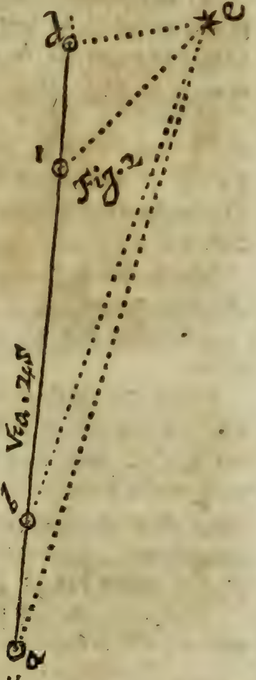
Ad locum Jovis *ex his Obſervationibus acquirendum, Angulos circuli verticalis*

ticalis cum Ecliptica ſupputavi ad h. 6. $51'\frac{1}{2}$ *& h.* 8. $18'\frac{2}{3}$. *quos inveni*

	h. 6.$51'\frac{1}{2}$. 35°.39'.	*h.*8.$18'\frac{2}{3}$. 46°.15'.
Jovis erat à Fixa diſtantia	7. 0".	7. 0".
Altitudinum differentia	2.14	3.42.
Ergo, ♃ *erat in conſequentia Fixæ*	2. 3.	1.44.
cum Latitudine majori	6.42.	6.47.
Quare Jovis latitudo vera	1.27.12	1.27.17.
Locus verus — *Streetio*	♍ 9. 56. 3.	9.55.44.
Mihi	9. 59. 23.	9.59. 4.

Jovis *locus è Tab.* Carolinis *ſupputatus h.* 8. 19'. *erat* ♍ 9°. 49'. 40". *deficiens ab Obſervatione* 6' 4". *Latitudo vera* 1°.28'. 57". *excedens obſervatam* 1'. 40". *In Ephemeridibus* Heckeri *Jovis locus* ♍ 9°. 45'. *Latitudo* 1°. 29'. *aberrans in longit.*13'. *in latit.*2'. *ferè.*





In Fig 1. *exhibetur Fixa in* ♍ 14°. 7'. *& Jovis apparens poſitio, h.*7.*circit, veſp*

- a. *eſt* ♃ *Obſervatus Feb.* 16.
- b. *eſt* ♃ *obſ. Feb.* 17.
- o. *eſt* ♃ *obſ.Feb.* 18.
- d. *eſt Fixa* ♌ 24.

In Fig. 2. *exhibetur tranſitus* ♃ *per Fixam in* ♍ 9°. $57'\frac{1}{2}$. *h. circ.*9.*veſp.*

- a. *eſt* ♃ *obſerv.Martii* 15.
- b. *eſt* ♃ *obſ. Mart.* 16.
- i. *eſt* ♃ *obſ. Mart.* 19.
- d. *eſt* ♃ *obſ. Mart.* 20.
- e. *eſt Fixa* ♌ 38.

In Ephemeridibus Heckeri.

Maii 30. *mane h.* 4. ♃ *ad Fixam in* ♍ 9°. $57'\frac{1}{2}$ *directus regredietur; ejus tamen latitudo erit modò* 1°.16'; *adeo* $4\frac{1}{2}'$ *ad Auſtrum à* ✱ *tranſibit.*

Junii 30. *h.* $2\frac{1}{2}$ *p.m. revertetur ad* ✱ *in* ♍ 14°. $7'\frac{1}{2}$; *ejus tamen latitudo erit* 1°. 14'. *ſic ut Auſtralior futurus ſit ſtellâ* $3\frac{1}{2}'$.

A

A Relation of the Return of a Great permanent Spot *in the Planet* Jupiter, *obſerved by Signor* Caſſini, *one of the Royal Pariſian Academy of the Sciences.*

'TIS now above ſix years, that Signor *Caſſini* publiſhed the Theory of two ſorts of *Spots*, at certain times to be ſeen in the Diſque of *Jupiter* *.

One ſort are nothing but the Shadows of the four Satellits, which he had often very well obſerved, when theſe Satellits, moving through the lower part of their ſmall circles that environ *Jupiter*, did paſs between him and the Sun which illuminates him, making a kind of Solar Eclipſe, like that which the Moon maketh, when ſhe is between the Sun and the Earth. Theſe Spots, as he obſerved from that time, have this peculiar, which diſtinguiſheth them from all others, *that* they are preciſely found in that place of *Jupiter*, where ſome Satellit is ſeen by the Sun; *that* they go from the Oriental limb to the Occidental of the Diſque of *Jupiter* with a motion alwaies equal to that of the Satellit; *that* in reſpect to us they preceed the Satellit before the oppoſition of Jupiter to the Sun, and follow him after the oppoſition; *that* the further Jupiter is diſtant from the oppoſition, the greater is the apparent diſtance of the ſame Satellit; *that* at divers times of the Year this diſtance changeth in proportion of the annual Parallax of the Satellit, according as he is differently ſeen by the Sun and by the Earth; and *that* at one and the ſame time of the year, when divers Satellits happen to be between Jupiter and the Sun, the Spots correſpondent to them are diſtant from them in proportion of the ſemi-diameters of the circles of the ſame Satellits.

* *What was diſcovered of the* permanent *Spot in this Planet here in* England *by M.* Hook *An.* 1664. *in* May, *may be ſeen* N°. 1. *p.* 3. *compared with* N°. 4. *p.* 75. N°. 8. *p.* 143. N°. 12. *p.* 209. N°. 15. *p.* 246.

The *other* ſort of Spots have no dependance at all from the Satellits; but it ſeems, that they have ſome reſemblance to thoſe Spots that ſometimes appear in the Sun, or to thoſe that are alwaies ſeen in the Moon; and they are perhaps of the ſame nature with thoſe, that are called *Belts*. Theſe Spots do alſo move from the Eaſtern to the Weſtern limb of *Jupiter's* diſque; but their apparent motion is unequal, and ſwifter near the Center than the Circumference; and they never are ſo well ſeen as when they approach to the Center, they being very narrow and almoſt imperceptible, when they approach to the Circumference:

ference: which makes us believe, that they are flat, and ſuperficial to *Jupiter*.

Among theſe Spots of the ſecond ſort there is none ſo ſenſible, as one that is ſcituate between the two Belts, which in the diſque of *Jupiter* are ordinarily ſeen extended from eaſt to weſt; the largeſt of which is between the Center and the Northern limb, and the narroweſt is beyond the Center toward the Southern limb. This Spot is alwaies adhering to the *Southern Belt*; its diameter is about the tenth part of that of *Jupiter*; and at the time that its center is neareſt to that of *Jupiter*, it is diſtant from it about the third part of the ſemi-diameter of that Planet.

Signor *Caſſini*, after he had made many Obſervations of this Spot during the Summer of the year 1665, found, that the period of its apparent revolution is of *nine hours* and *fifty ſix minutes*; and having taken an *Epocha* of the time, when it arrived at the middle of the Belt, he calculated *Tables* and *Ephemerids* of its motion for the end of the ſaid year 1665, and for the beginning of 1666. He continued to obſerve it until the beginning of 1666, when *Jupiter* approached to the beams of the Sun; and the Obſervations were found conform enough to his Ephemerids. But after it was got free of the ſun-beams, this Spot was difficult to be diſcerned: And as this gave ground to believe, that it might be of the nature of the Spots of the Sun, which, after having appeared for a while, diſappear for ever, Signor *Caſſini* ceaſed at length to obſerve them.

But *Jan.* 19. of this preſent year 1672. (ſt. n.) when he obſerved *Jupiter* at 4¾ a clock in the morning, he perceived in the ſame place of his diſque the Figure of the ſame Spot, adhering to the ſame *Southern Belt*. It was already gone beyond the moiety of this Belt, and he ſaw it advance little by little towards the Weſtern limb, to which it ſeemed to be very near at 6¼ a clock: But it then appeared ſo ſmall and little, and ſo little ſenſible, that he was obliged to ceaſe from obſerving it.

By the Celerity of its motion near the Center, and by the place where he had begun to ſee it, he judged, that it might have been in the midſt of the *Belt* at 4 a clock and 35 min. in the morning: And as he prepared himſelf to make *Ephemerides* of its motion for this preſent year 1672, he perceived, that in thoſe, he had made for the year 1666, by good luck, this Spot had been in the midſt of *Jupiter* the ſame day, namely the *19th* of *January* at the ſame hour in the morning, the reduction of hours being made by the difference of the *Meridians*. So that by the calcul he made, in ſix years, of which one is a *Biſſextile*, it is found to have made, in reſpect of the Earth, at leaſt 5294 revolutions, each of 9 hours 55 minutes, 58 ſeconds, compenſating one revolution by another; and at moſt 5295 revolutions of 9 hours, 55 minutes, 51 ſeconds; foraſmuch as he was aſſured of the preciſeneſs of one *Mean* Revolution to one eight of a minute: which will be verified by future obſervations. Thus the *Ephemerides* were found ready made for the firſt months of this preſent year, but only that we are a little differently to apply the Equations, that amount to ſome minutes, becauſe that the diſtance, which *Jupiter* now is at from the Sun and from his Apogee, is different from that, which he was at in the beginning of the year 1666; and that in this preſent year after the month of *February*, that day is to be counted which hath been added for the *Biſ-ſextile*. The Obſervations, which Signor *Caſſini* hath continued to make ſince the *19th* of *January*, as far as the weather did permit, have alwaies been found conform to thoſe *Ephemerides*.

Until then he had never yet ſeen an *immediate* return of this Spot after 9 hours and 56 minutes, becauſe it had not hapned, that *Jupiter* after the apparition of the Spot had ſtay'd, in one and the ſame night, long enough above the Horizon, at leaſt at a ſufficient height to obſerve him with due diſtinctneſs. He had only concluded the time of this revolution by returns obſerved after about 20, 30, and 50 hours; and he had more preciſely limited it by obſervations more diſtant. But the night after the 1 day of *March*, at 7½ a clock in the evening, he ſaw this Spot in the midſt of the Belt; and the ſame night, at 5 a clock and 26 minutes in the morning, he ſaw it again returned preciſely to the ſame place. Next day he made a report of theſe Obſervations to the *R. Academy of the Sciences*, and predicted, that the Spot would arrive again at the midſt of the Belt *March 3d* at 9 a clock and 8 minutes at night, whereupon that Aſſembly deputed M. *Buot* and M. *Mariotte* to be preſent at the Obſervation; who being come to the *R. Obſervatory* began to ſee at 8 a clock and 4 minutes the Spot already ſomewhat removed from the Oriental limb, but yet obſcure and ſmall. At 8 a clock and 47 minutes they ſaw it very diſtinctly advancing

towards

towards the middle of the Belt. From 9 a clock 5 minutes and 40 ſeconds, untill 9 a clock and 8 minutes, they ſaw it in the midſt of the Belt. At 9 a clock and 15 minutes it was paſſed the middle, and was come nearer to the Occidental limb. And a little after the Heavens being over-caſt, he could then obſerve it no further.

This Obſervation being taken for the *Epocha*, it is eaſie to find hereafter the times, when this Spot ſhall return to the midſt of the Belt. For you are only to add alwaies 9 hours and 56 minutes, and, for greater preciſenes's ſake, not to omit the ordinary Equation of days, that depends from the inequality of the motion of the Sun in reſpect of the Equinoctial, nor the particular Equation, that depends from the inequality of the motion of *Jupiter* according to the diverſity of the diſtance of the Sun and his Apogee.

This Revolution being the ſwifteſt and the moſt regular that is hitherto known in the Heavens, a Travellour alone, even without having any correſpondence with other Obſervers, may make uſe of it to find the *Longitudes* of the moſt remote places of the Earth. We ſhall hereafter examine, to what preciſeneſs we may arrive by this way.

Obſervations of a New Comet, *made at* Paris *in the Royal Obſervatory by Signor* Caſſini.

THere now appears a Comet, which ſeems to be near the end of his Appearance, and which might have been ſeen above a month ſince, if the weather had been favourable. But he being very ſmall, and having been a long while obſerved by the beams of the Sun, to which he was nigh, and afterwards by the Moon, which was greatly advanced in her light, beſides that the Heavens in theſe parts have often been over-caſt, we have not obſerved him but lately.

The Mathematicians of *la Fleſche* perceived him from the 16 of March, and gave us here at *Paris* the firſt notice of it. Thoſe of the College of *Clermont* being advertiſed of it, ſaw him the 25*th* of the ſame month. And upon notice given of it to the *R. Academy of the Sciences* by *P. Pardies*, Profeſſor of the Mathematicks in the College of *Clermont*, Signor *Caſſini* hath ever ſince been obſerving him as much as the weather did permit

March 26.h.7$\frac{1}{2}$. in the evening, he ſaw him between the Head of *Meduſa* and the *Pleiades*; without a Teleſcope he appeared no otherwiſe than a Star of the third magnitude. He appeared bigger by Teleſcopes, and ſurpaſſed much the Stars of the firſt magnitude; but he was very dark, as if it had been nothing but a ſmall whitiſh cloud, and we could hardly perceive him, when we held a light to the threds of our Teleſcopes applied to the inſtruments, inſtead of *Sights*, for to obſerve with greater preciſeneſs.

His *Head*, ſeen with a Teleſcope of 17 foot, appeared almoſt round; but it was well defined, and diſtinguiſh't from the miſtineſs, which formed a kind of chevelure, wherewith it was encompaſſed; and even the middle was a little confuſed, and ſeemed to have inequalities, as are ſeen in clouds.

The *Tayl*, which is principally that which diſtinguiſheth Comets from Stars, was almoſt imperceptible; yet by the Teleſcope it was ſeen turned oppoſite to the Sun, and it appeared of the length of two diameters of the Head or thereabout: For it was not eaſie, to meaſure it preciſely, becauſe being thinner according as it was farther from the Head, its extremity was inſenſibly loſt. And ſo the whole Comet, Head, Tail, and Chevelure taken altogether, took up no more than 3 or 4 minutes of a degree.

H. 7.48'. he was in a ſtreight line with the *Lucida* in the Head of *Meduſe*, and with the moſt Occidental one of the *Pleiades*; and above the two cleareſt Stars of the Southern foot of *Perſeus*; ſo that a ſtreight line, drawn through theſe two Stars, did almoſt touch the Southern extremity of his Chevelure. This place of the Comet, transferred upon the Map of the Fixt Stars, fell preciſely enough upon 23°.25'. of the ſign of *Taurus*, in 14 degrees of Northern Latitude. Mean time, we were fain to content our ſelves with determining after this manner the place of the Comet, becauſe of the difficulty we found to ſee him by the Inſtruments, when the light was held to them, as was ſaid above.

With a Teleſcope of 3 foot, we ſaw near the Comet two ſmall Stars, diſtant one diameter of the Sun from one another, which ſtars are not in the Catalogues. The Comet was in a manner between thoſe two ſtars, and little by little he approached to the ſtreight line, drawn from the one to the other. Signor *Caſſini* waited the time of its being preciſely in this ſtreight line; which hapned at h.9.15': and then he found, that he was not exactly in the midſt of theſe two ſtars, and that his center was a little nigher to that, which was weſt-ward: But h.9. 33'. he was equally diſtant from them both. This Obſervation was made on purpoſe to know the *parallax* of the Comet, if happily ſome other Obſerver ſhall have obſerved him in a remote Country: whence it may be judged, how far he was diſtant from the Earth. It was taken notice of, that from h.8.5″. of the evening, until h.10. 26′. he made, in reſpect of theſe two ſtars, an oblique motion ſenſible enough, going from North to South in the ſame time that he advanced from Weſt to Eaſt.

Beſides theſe two Stars, there were on the North of the Comet three other ſmall ones, equally diſtant from one another, and placed in a ſtreight line; and Weſt-ward we ſaw a fourth beneath the Head of the Comet, from which ſhe was diſtant about two diameters of the Comet. Theſe 4 laſt Stars were ſo ſmall, that we could not ſee them, even with a three foot Teleſcope; but we eaſily diſtinguiſh't them with one of 17 feet.

The Clouds hid the Comet about h.10. at night, and they alſo kept us from ſeeing him the next night of March 27.

March 28. h. 7. 42′. in the evening the Comet was diſtant from the leſs bright ſtar of the Southern foot of *Perſeus*, no more than about 24′. weſtward. He had almoſt the ſame Latitude with this Star; ſo that he was preciſely enough at 26.deg. 8′.of the ſign of *Taurus*, and in the latit. of 12 deg.8′. We tryed to take the diſtance of the Comet to the moſt remote fixt ſtars; but we found great difficulty in it: for we ſaw the Comet not diſtinctly enough by the Teleſcopes applied to the Inſtruments, when we held a light to the threds; and beſides, there was a very rough wind, which did exceedingly diſcommode the Obſervers.

Yet notwithſtanding, h.8. 14′. we took, as well as we could, the diſtance of the Comet to the Star in the Eye of *Taurus* called *Aldebaran*, and we found, that this diſtance was of 19. deg.38′: And h. 8. 29′. the diſtance of the Comet to the Star, called *Capella*, was found to be of 22. deg. 32′. When we were preparing our ſelves to verifie theſe diſtances, the clouds covering the heavens interrupted the obſervation.

The ſame evening, when we beheld the Comet with Teleſcopes, we ſaw about his head a chevelure of an almoſt equal length, without being able clearly to diſtinguiſh his tail oppoſite to the Sun. 'Tis true, that the Air was not clear enough, and even at the place of the Comet there were ſome ſmall clouds.

March 29. we could not obſerve, becauſe the Sky was wholly over-caſt.

March 30.h.9.35'.at night,the Comet ſeen without a Teleſcope appeared no otherwiſe than a Star of the 4th magnitude: through the Teleſcope he exceeded even thoſe of the firſt;but he was very dark,and in what manner ſoever we looked upon him, we could obſerve almoſt no tayl at all of him. He had paſſed one degree and an half beneath the *Lucida* of the Southern foot of *Perſeus*; ſo that this ſtar was exactly in the midſt of the Comet and the little ſtar of the leg of *Perſeus*,marked η by *Bayerus*, which then we ſaw not but by a Teleſcope. A ſtreight line, drawn from one of theſe ſtars to the other,did almoſt touch the Southern limb of the Comet,which being transferred upon the Map of the Fixt Stars, fell upon 28 deg. and 45'. of *Taurus*,in the Northern latit. of 9. deg. 56'.

H. 9. 45'. Signor *Caſſini* compared the Comet with the leſs bright Star of the Southern foot of *Perſeus*,near which he had been *March* 28; and he found, that the Weſtern limb of the Comet touched a ſtreight line,drawn through this leſs bright ſtar of *Perſeus*'s Southern foot, and through the moſt Northern of the Head of *Taurus*; but that he was already got ſomewhat nearer to the latter. This made him judge,that the Comet, which had left,on the North-ſide,all the Stars of the Southern foot of *Perſeus*, would in the progreſs of his courſe leave, on the South-ſide,all the moſt Northern ſtars of the head of *Taurus*.

March 31. h. 8. in the evening, the Comet was in a direct line with the *Lucida* in the foot of *Perſeus*,and with the moſt Northern in the Head of *Taurus*; but he was more than twice as much remoter from the firſt than the other,and being transferred upon the Map of the fixt ſtars,he was found at 15 minutes from *Gemini*, in the latit. of 8 deg. 49'. During the whole time that we could obſerve him this night, (which was till 10 a clock,) he quitted not this ſtreight line, which was almoſt parallel to the horizon: notwithſtanding that his own particular motion ſhould raiſe him a little above it; as the parallax,on the contrary,ſhould ſink him beneath it in approaching to the horizon. It may be,there was a compenſation made of theſe two contrary motions: poſſibly alſo the effect of both was not ſenſible; which ought to be examined. If it be found,that in ſome remote quarters the ſame obſervation have been made, the *parallax* will be determined by comparing the Obſervations.

April 1. the Comet could not be ſeen without a Teleſcope, becauſe the Moon,being very near it, hid him from our ſight. But with a Teleſcope only of one foot we diſcerned him eaſily enough, and found, that he had paſſed 45′. minutes beyond the moſt Northern ſtar of the Head of *Taurus*, and that he muſt have touch't it by his Southern limb; as alſo that he was diſtant one degree and 43′. from the Star that was neareſt to that toward the South. This place being transferred upon the Map of the fixt ſtars, we found, that he was at 1. deg. and 30′. of *Gemini*, in the Northern Latit. of 7 deg. 44′.

Signor *Caſſini*, having conſidered theſe two ſtars, obſerved, *that* the ſecond is not leſs bright than the firſt; and yet that *Bayerus* hath not marked it, who hath made an exact enumeration of the Stars that may eaſily be ſeen with the naked eye; and *that* at firſt ſight it ſeems, that *Tycho* hath left it out in his Catalogue. For he puts 4 ſtars in the place he calls *in quadrilatero cervicis*, and he ſpeaks not of this which is the 5th, and maketh with the other four an irregular pentagone. 'Tis true, that beſides theſe 4 ſtars, after he hath marked 13 others of them, he puts yet one by it ſelf for the laſt, which he calls *in quadrilatero colli præcedens*; as if, beſides the firſt quadrilateral, there were yet another in the Neck of *Taurus*. Mean time there is in this place but 5 ſtars of the 5th magnitude, which make not a quadrilateral figure; but a pentagone, as I was juſt now ſaying.

This omiſſion of *Bayerus*, and the denomination, which *Tycho* uſeth to denote theſe Stars, which ſuits not with the number nor the configuration that now appears, do adminiſter cauſe to doubt, whether the Star in queſtion be not one of thoſe that appear from time to time; as there are two in the conſtellation of the *Swan*, and another in the neck of the *Whale*. We ſhall particularly take heed of this place of the Heavens, to clear up this doubt.

April 2. h. 8. in the even, Signor *Caſſini*, having obſerved the Comet with a Teleſcope of one foot, which diſcovered 5 degrees, found, that he was two degrees and an half diſtant from the moſt Northern ſtar of *Taurus*; and one degree from the ſtar of the Ear, marked φ by *Bayerus*, and by *Tycho* called *ſequentis lateris Borea*.

Two lines drawn from the moſt Northern ſtar of *Taurus*, one to the Comet, the other to the Star that is wanting in *Bayerus*, made a right angle; and the diſtance of the Comet to this angle was double to that, which is between theſe two Stars. This place transferred upon the Map of the fixed Stars, fell on 2 degrees and 48′. of *Gemini*, in the Northern latit. of 6. deg. and 40′.

H.6.50'. The line drawn through the horns of the Moon paſs'd through the Star, that is at the point of the Northern horn of *Taurus*, and the diſtance of this Star to the Northren horn of the ☽ was by a Minut greater than the Semi-diameter of the Moon.

April. 3. The Sky was ſo cover'd, that we deſpair'd to obſerve the Comet that night: yet notwithſtanding the Clouds being ſomewhat diſpelled h. 9. we ſaw him with one foot Teleſcope. He had paſſed over the upper Star of the Ear of *Taurus*, and he made with this Star the *baſis* of an *Iſoſceles* triangle, on the top whereof was the inferiour Star of the Ear. The two ſides of this Triangle were two times and an half bigger than the *baſis*; ſo that the Comet was at four degrees from the ſign of *Gemini*, in the Northern Latit. of 5 degr. and 38'. The clouds being almoſt preſently return'd, we could obſerve no further.

April 4. The Heaven was conſtantly cover'd, ſo that we could make no Obſervation at all.

April. 5. h. 8. at even, the Comet had paſs'd the Northern Ear of *Taurus*, and was equally diſtant from the upper Star of the Northern Ear, and from that which was on the front of *Taurus*. He was alſo as diſtant from the inferior Star of the Ear of *Taurus*, as this Star is from the next Weſt-ward, by Tycho call'd *inferior præcedentis lateris quadrilateri*; and a ſtreight line, drawn through the Comet and the upper Star of the Ear, made an almoſt right angle with an other line, drawn from the Comet to the inferior of the two ſmall ſtars, that are above the Eye of *Taurus*. This place being carried over to the Map of the fixt ſtars, the Comet was found at 6. deg. 18'. of the ſign of *Gemini*, in the Northern latit. of 3. deg. 41'. He was ſo confuſed this night, that even with the 17 foot Teleſcope we could not exactly diſtinguiſh the Head from the Chevelure, which environed him. The whole appear'd a little bigger than the diſque of *Jupiter*, ſeen by the ſame Teleſcope.

Apr. 6. h. 8. at even, a ſtreight line drawn from the Comet to the ſtar that is in the front of *Taurus*, made a right angle with an other ſtreight line drawn from this ſame ſtar to the inferiour of the two that are above the Eye: And the diſtance of this later ſtar to that of *Taurus* was twice the diſtance of the ſame ſtar of the front of *Taurus* to the Comet. This place being transferr'd upon the Map of the fixt ſtars, the Comet was found at 7. deg. 25' of *Gemini*, in the Northern latit. of 2. deg. 45'. H. 9. 6'. we ſaw on the ſide of the Comet a ſtar ſufficiently clear, which was not further diſtant from him, than a little more than the diameter of the Comet, and that was at the ſame height of the Horizon: which may ſerve to determine the *parallax*, if the ſame obſervation be made elſwhere.

April.7.h.9. in the evening, the Comet was equally diſtant from the inferior ſtar of the Northern Ear of *Taurus*, and from the ſuperior of the root of the Northern horn. He was alſo as far diſtant from this latter ſtar, as this ſtar is from that of the front. This place, being carried over to the Map of the fixt ſtars, fell on 8. degrees and 30′. of *Gemini*, in the Northren latit. of 1. degree and 56′. As we were preparing to obſerve with the great Teleſcope, the Heaven was clouded over.

April. 8.9 and 10. we could make no obſervation at all, becauſe of the conſtant dark weather.

Signor Caſſini's *reflections on the foregoing Obſervations.*

All the places of the Comet, that we have obſerved till now, fall into a line little differing from an Arch of a great Circle, which cuts the Ecliptique in the 10*th*. deg. 45′. of *Gemini*, and which conſequently hath its greateſt latitude in the 10*th*. degree and 45′. of *Piſces*; which latitude is between 39. and 40. deg. Nord-ward. The ſame Circle cuts the *Equator* at 101. degrees of the Vernal Section Eaſt-ward, and its greateſt declination from the *Equator* Nord-ward is of $38\frac{1}{2}$ degrees. Whence it follows, that the Comet at the time of his greateſt Declination, wherein it may have ſtay'd a conſiderable time, hath touch'd the horizon of thoſe that are in the latitude of $51\frac{1}{2}$ degrees; the parallel of whom paſſeth through the lower part of *England*, and through *Zealand*, *Weſtphalia*, *Saxony*, *Poland* &c: And that he hath remain'd at that time all night and all day above the horizon of the moſt Northern people; as are thoſe of the upper part of *England*, *Holland*, *Pomerania*, &c But that he hath paſs'd through the Zenith of the lower part of *Spain*, and through *Sardinia*, *Calabria*, *Chio*, *Smyrna*, &c; yet without having been perceived in thoſe places, becauſe he there paſs'd in the day-time.

Since we could not ſee this Comet but about the end of *March*, we have made uſe of our method explained in the Theory of the Comet of the year 1665, to find the places whereabout this Comet hath been during the moneth of *March*, in the Hypotheſis of the equal rectilineal motion, which ſerveth to repreſent the places of Comets for ſome time of their apparition, but not for the whole time: as we have ſhew'd in that Theory.

Having therefore choſen two of our firſt Obſervations, (becauſe the latter are not ſo proper for this purpoſe,) and having taken a Mean between the firſt Obſervations of the Mathematicians of *la Fleſche*, we have found by this method, that the Comet had been in his Perigee the 12*th*. of *March* at 8 a clock in the morning: *that* in that time, which is that of his greateſt apparent celerity, he made about 2. deg. 32'. a day in the great Circle of his *apparent* motion, and $\frac{444}{10000}$. of his perigee-diſtance in the line of his *equal* motion: *that* he was in his greateſt Declination the 11*th*. and 12*th*. of March; and *that* at that time he paſs'd through the inferiour Meridian at about two a clock after midnight. Wherefore, if the weather hath been favourable, he muſt have been obſerv'd by Mr. *Hevelius*, who hath ſeen him, witneſs his Letter, from the 6*th*. of *March*; * at which time he was in perigee and made the biggeſt ſhew.

* *See No*. 81. *p*. 4017.

If we have rightly determin'd his Perigee, and that the *hypotheſis* of the equality of his motion be juſt for that time, nor he hath begun to appear but when he was ſufficiently nigh to the Earth; then he hath been viſible ſince the middle of *February*, at which time he was as far diſtant from his perigee by approaching to the Earth, as he is at the preſent by receding from it. He muſt then have been at the extremity of the Southern wing of the *Swan*, and arriv'd at the Southern foot of *Pegaſus* on the 23*th*. of *February*, of the ſame bigneſs that he was ſeen to be of, *March* 28. He muſt have arrived at the Stars of the Northern Arm of *Andromeda*, *March the 9th*; at thoſe of her *Girdle*, the 12*th*. when he was in his Perigee, and in his greateſt declination; to her Southern Legg, *March* 15*th*; between her Southern Legg and the Triangle, *March* 18*th*. very near as he was obſerv'd at *la Fleſche*; and under the head of *Meduſa*, *March* 25*th*. The dayes enſuing he muſt have arriv'd at the places marked in our firſt Obſervations: But in the laſt, he hath been ſwifter than this *Hypotheſis* will bear. To repreſent theſe latter Obſervations, the Line of the motion ought to have been made curve, as we did for the end of the apparent motion of the Comet of 1665, with this difference, that inſtead of *that* lines being convex in regard of the Earth, becauſe the motion was retrograde, *this* was to be made Concave towards the Earth; ſuitable to what hath been ſaid in the ſame Theory, becauſe that the motion of this Comet is direct.

According to this *Hypotheſis*, thoſe laſt daies, that the Clouds hindred us from ſeeing this Comet, he muſt have continued his courſe towards the root of the Southern horn of *Taurus*, and having paſs'd the Ecliptique between the 9*th* and 10*th* of *April*, he muſt paſs on the top of *Orion's* head the 20*th*; over his Arm the 24*th*; and at the end of this month he will be in the *Milky Way*. But it will be difficult hence forward to find him, becauſe of his ſmallneſs, and the light of the Moon.

'Tis a thing worth obſerving, that this Comet keeps his courſe almoſt like that of the 2*d* Comet of 1665, and of another of 1577 obſerv'd by *Tycho*. For they have paſs'd through almoſt the ſame Conſtellations; though this be more inclined Nord-ward, and cut the Ecliptique five or ſix degrees more forward than that of 1665. So that it ſeems, that in this place of the Heavens there is, as 'twere, a *Zodiaque* for Comets.

An Account of ſome Books.

I. *De RESISTENTIA SOLIDORUM* Alexan. Marchetti, *in Piſana Academia Phil. Prof. Excuſum* Florentiæ 1665 *in thin* 4°.

THis book came not long ſince to my hands: It had been promiſed ſome years before under the Title of *Galilæus ampliatus*. But the Author now follows not the Steps of *Galilæus*, but demonſtrates all his Propoſitions another way; building all upon this ground: *Momenta Gravium proportionem habent compoſitam ex proportionibus ponderum & longitudinum*: which is his firſt Proportion. This Book being but ſmall, and the ſubject admitting of enlargement, the Author promiſeth a larger Treatiſe of the ſame.

II. *Tabula numerorum QUADRATORUM decies millium, unà cum ipſorum LATERIBUS ab Unitate incipientibus, & ordine naturali uſque ad* 10000. *progredientibus*. Londini, 1672.

A Table of ten thouſand *Square numbers*, namely of all the Square Numbers between 0 and 100 milions; and of their *Sides* or *Roots*: Which are all the whole Numbers between 0 and ten thouſand: 8 ſheets in fol.

The Concinnity of 10, 8 or 7. Centuries in each opening, may ſo pleaſe ſome Reader's eye as to invite him to continue the

Table to 100 thouſand Squares, placed in the ſame order. But Arithmeticians will ſee divers advantages, which would have been loſt, if there had been more or fewer lines in a page; or if the Centuries had not ſtood entire in every aperture.

The two laſt pages are ſufficiently contained in p. 30. which preceeds them, if men were acquainted with the compendious way of writing in *Cribris*. That fair edition of *Aratus*, printed this year in *Oxford*, adjoins ſome fragments of *Eratoſthenes* (who dyed almoſt 1900 yeares ago.) Among the *reſt*, there is the *beginning* of his Arithmetical *κόσκινον* of odd numbers, to ſhew, which of them are incompoſit &c. The loſs of that *cribrum* was abundantly ſupplied by the *Table* of incompoſit numbers, printed at *London* for Mr. *Pitt*. 1668; as this Table is.

Thoſe 3 laſt pages have a Curioſity, perhaps not ſeen before; viz. an accurate enumeration of all the *Endings* of numbers truly Square. Thoſe *Endings* in *one* figure are ſix; in *two* figures, are 22; in *three* figures, are 159; in 4. figures, are 144: which, being here ſet down in their natural order, ſtand there ready to diſcover many long given numbers not to be Square; which otherwiſe could not have been perceived to be ſuch till after extraction.

But they alſo give an occaſion to tranſcribe here the *three laſt* lines of the laſt page, which are theſe.

"*Having the two three or* four *laſt figures of any Square number*, "*to exhibit as many of the* laſt *figures of its ſide*, is a new Queſtion; "to which the juſt anſwers are manifold and not obvious. *A* "*particular Account* of them is *ready for the preſs*, when it ſhall be deſired.

In the mean time, the Publiſher, having ſeen the ſaid Account in the hands of the Author (Doctor *Pell*,) is able, for the clearing of thoſe words [*the juſt anſwers are manifold*] to add thus much:

When the Queſtion is concerning the 22 Combinations, 20 of them have 4 Anſwers a peice; 50 of them have, each of them, 10 Anſwers.

When the Queſtion is concerning the 159 Ternions; 100 of them have 4 Anſwers a peice: 50 of them have, each, 8 Anſwers; Two of them have, each, *ten* Anſwers; *Five* of them, have each, 20 Anſwers; *Two* have, each of them, 40 Anſwers.

When the Queſtion is concerning the 1044 Quaternions ; 1000 of them have 8 Anſwers a peice ; 40 of them have, each, 40 Anſwers ; four of them have, each, 100 Anſwers :

As it is hoped, will ſhortly appear in print ; that ſo the Excellent Author may proceed to publiſh his higher and more plauſible ſuperſtructures.

III. Regneri de Graaf. *de MVLIERVM ORGANIS GENERATIONI INSERVIENTIBVS Tractatus novus.* Lugduni Batavorum, 1672 *in* 8°.

WHat this Inquiſitive and Induſtrious Anatomiſt had formerly promiſed touching this Subject (intimated N°. 34. p. *663*. and N°. 79. p. 30*56*. 30*57*.) he now amply performeth in this Treatiſe, which appears to be written upon long ſearch and much examination, and is illuſtrated with many very curious and accurate Schemes.

The main Deſign of the Book is, to make it out what the Author as well, as *Van Horn, Steno, Swammerdam,* and others have given out concerning the Manner of Generation in Animals call'd *Viviparous* ; viz. that they, no leſs than the *Oviparous*, have *Ovaria* containing many Eggs ; and that thoſe Eggs are after the ſame manner rendred prolifick, and come to the *Vterus*, as they do in Fowl : which he ſaith will be found more than probable to thoſe, that ſhall have well examin'd the Genitals of Oviparous creatures ; in regard that, as the extremity of the *Oviductus* or Egg-channel ends in a membranous expanſion in Birds ; ſo the *Tubæ Fallopianæ* do end likewiſe in Quadrupeds. And as the ſame *Oviductus* in Birds receiveth the Eggs falling from their buds ; ſo the ſaid dilated *Tubæ* in Quadrupeds do receive the Eggs expell'd out of the Baggs. Which that it may be the better clear'd up, he obſerveth.

1. *Ova hæc in teſtibus generari ac perfici, eodem modo quo vitelli in Avium ovariis ſolent ; quatenus ſcil. per arterias præparantes ſanguis ad teſtes affluens, in membranoſa illorum ſubſtantia materiam iis generandis ac nutriendis relinquit.*

2. *Ova è teſtibus expelli, quoties maſculino ſemine irradiata, brevi poſt coitum fæcundum, inter eorum tunicas, glanduloſa quædam ſubſtantia excreſcit, quæ Ovum tamdiu comprimit, donec per papillam, in extrema folliculi ſuperficie conſpicuam, erumpat ; idque vel citiùs vel tardiùs, prout animalia longiori aut breviori tempore uterum gerunt.*

3. *Ova hac ratione è teſtibus propulſa neceſſariò in Abdominis cavum eſſe delapſura, niſi* Tubæ Fallopianæ *inexplicabili, at viſibili tamen, modo ova illa exciperent, & ad uterum deveherent:* Viſibilem *dicit, cùm ſæpius id conſpexiſſe ſe, & indies ſe demonſtrare poſſe affirmet.*

Whereunto he adds the changes, which thoſe Eggs daily undergo in *utero:* All which things coming to paſs in Cows, Ewes, and other Animals, frequently diſſected by him, he concludeth, that Generation in *Women* alſo is made after the ſame manner, *quippe quæ ova in teſtibus, & tubas utero annexas, uti bruta animantia, obtineant.*

Mean time, he would not have any one phancy, that the Eggs in Quadrupeds and Women are inveſted with a hard ſhell: that being not eſſential to an Egg, and there being more ſorts of Eggs that have no ſuch hard ſhell, than that have it; as of Fiſhes, Froggs, Serpents, &c.

Nec putare nos velit, in Mulieribus & cæteris Viviparis, iſto quo in Gallinis modo, per unum alterumve diem Mari commiſſis, omnia omninò Ova fæcunda reddi; cum ne quidem in omni Avium genere id fieri certum ſit, in quorum aliis duo, in aliis tria, in aliis quatuor, in nonnullis decem & plura Ova ſimul fæcundentur & ab iis excludantur. Mulieres verò, quanquam & ipſæ plura in Ovariis ova contineant, plærumque tamen in noſtris regionibus unum tantum Ovum, maſculino ſemine irradiatum, è teſtibus in uterum expellant; quanquam & plura interdum eodem ſimul coitu irrorari citra miraculum poſſint: cujus rei multa apud Caſp Bauhinum l. 1. *de Hermaphr. c.* 8. *exempla legantur; ubi nunc tres, nunc quinque, nunc decem & plures fœtus uno partu editos reperies; quod canibus, fœtibus, cuniculis &c. perquam familiare eſt. Ubi tamen notatu dignum, in iſtis animalibus tot paſſim folliculos in teſtibus exiſtere, quot fœtus aut Ova in utero, & nunquam in utero plures fœtus adeſſe, quàm folliculos in teſtibus; ita ut ex teſtibus ſolis, fœtuum in utero exiſtentium numerus dignoſci poſſit.*

But, beſides the clearing of this matter and the difficulties and objections raiſed againſt it, the Author is very full and accurate, in deſcribing the *Genitalia Mulierum* themſelves.

Moreover he giveth us two curious and inſtructive Schemes *de partibus Genitalibus Galli & Gallinæ*, together with their Explication. And he omits not to deliver a minute deſciption of the *Tubæ Fallopianæ mulierum*; and ſhews, whence it is, that by ſome they are eſteem'd altogether and alwaies cloſe, whereas they are at certain times really open, though the hole of their extremity be very narrow; p. 246. He rejects the (commonly ſo called) *Vaſa deferentia* from being fit veſſels for tranſmitting Eggs, p. 250. as he alſo contradicts the aſſertion of thoſe, that pretend to have found humane *fœtus's* of no more than 3, 4. or 8, daies old after conception, p. 246.

* See Numb. 81. p. 4021.

Further he informs us, How an Egg is by degrees changed in *utero*; how it is nouriſhed and augmented there from time to time; and in what order each part is perfected &c. Concerning which, the Reader will probably receive in a ſhort time ſome diſcoveries, made, and lately imparted to the *Royal Society*, by Signor *Malpighi*, an Italian, and Dr. *Croon* an Engliſh phyſitian, both Fellows of that Society. He concludeth all with an excellent Chapter, treating of the Generation of *Rabbets*, and thereby confirming all the main parts of his former doctrine.

IV. *Diſcours de la CONOISSANCE des BESTES*; *par le P.* Ignace Gaſton Pardies, *S. J.* *A* Paris 1672. *in* 12°.

THe learn'd Author of this Book examines therein the Opinion of thoſe, that eſteem Beaſts to be meer Engins without any perception and Knowledge. In the doing of which, he repreſents at large and to advantage what hath been and may be alledged in favour of that doctrine; that ſo, when he ſhall be found by the Teachers of it not to be of their ſentiment, they may not Judge him to be a Diſſenter at leaſt for want of having conſidered their reaſons.

After he hath ſpent the greateſt part of his diſcourſe in urging the arguments for the ſole Mechanical Contrivance of the Structure and Operations of Beaſts; and interſperſed the diſcuſſion of the Opinion *of the other extreme*, which adſcribes *Reaſon* to them: He declares at laſt his ſenſe of this whole matter, and endeavours to prove, That Beaſts, though they have not any *Intellectual*, yet they have a *Senſible* knowledg; or, though they have not ſuch a perception that eſſentially carrieth with it a reflection upon it ſelf; yet they have a ſimple apprehenſion of Objects without that reflexion. So that he eſteems, that from this diſtinction all the difficulties, that have been propoſed, will vaniſh; and that the reaſons, alledged to the contrary, proove indeed, that Beaſts have no *S*piritual knowledge, but not at all, that they have no Senſible one. For the particulars, whereby this is endeavoured to be made out, we refer the Reader to the Book itſelf.

Advertiſement.

A ſhort Eſſay *Printed in half a ſheet of Paper, wherein Rules are laid down, directing, how to divide a Period into ſentences; with what Points the Sentences ſhall be diſtinguiſhed, and how to read thoſe Sentences Grammatically; more diſtinct than what has been formerly done: Very uſeful for the clearneſs of any diſcourſe, and for expedit and diſtinct reading.* By *M.* Lewis: *Sold by* Thomas Parkhurſt *at the* Bible *and* Crown *in* Cheapſide, *and M.* Milion, *at the* Bible *in* Fleetſtreet.

ERRATA in N°. 81, P. 4011. l. 17. (=*DO*) l. 26. 2 ſ v^3. ibid. pro 5^2 leg. s^2. l. 29. pro, *alia VC* leg. *aliâve*. p. 4012. l. 10. *cæteriſque* l. 12. *n* v h *x*. l. 13. $\frac{vh = s2}{nr2 - vhx}nx$. l. 14. $\frac{s^2x}{r^2 - rx}$ p. 4014. l. 14. poſt *Va*, add, *& æqualiter accelerato ſecundùm AV vel Ya*. l. 19. *& completo.* l. 25. *natarum.* l. 27. *rectis Yv.* l. 31. *VF.* p. 4015. l. 12. *AC.* $\alpha E = \frac{a}{q}r$. p. 4016. l. 1 *CM. CS* : : l. 12. *conveniat.* l. 14. *accommodandus.*

LONDON,
Printed for *John Martyn*, Printer to the *Royal Society*. 1672.

Numb. 83

PHILOSOPHICAL TRANSACTIONS.

May 20. 1672.

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Some Conſiderations of Mr. Iſaac Newton *upon part of a Letter of M.* de Bercé, *concerning his Reflecting Teleſcope pretended to be improv'd by M.* Caſſegrain. *Some Experiments propoſed in relation to the ſame Mr.* Newtons *Theory of Light; together with the Obſervations by him made thereon. An Account communicated by Mr.* Liſter, *of a Stone cut out from under the Tongue of a Man. An Extract of a Letter of the ſame, concerning animated Horſe-hairs. Some Obſervations, made by Signor* Thomas Cornelio, *of Perſons pretendimg to be ſtung by* Tarantulas. *An Account of the* Aponenſian *Baths in* Italy, *by* John Dodington *Eſquire. Reflexions made by P.* Lana *upon an Obſervation relating to the* formation *of Cryſtals. A Relation of an Inland-*Sea *near* Danzick, *yeilding a green Subſtance which cauſeth certain Death; by Mr.* Kirkby. *An Account of ſome Books.* I. *de ANIMA BRUTORUM, Exercitationes duæ, Auth.* Thoma Willis *M.D.&c.* II. *Suite des nouvelles Experiences ſur la VIPERE; par* Moyſe Charas. III. *The CHIRURGICAL and ANATOMICAL Works of* Paul Barbette *M.D; together with a Treatiſe of the Plague.* IV. *The AMERICAN PHYSITIAN. by W.* Hughes.

Mr. Iſaac Newton's *Conſiderations upon part of a Letter of Monſieur de* Bercé *printed in the Eight French* Memoire, *concerning the Cata-drioptrical Teleſcope, pretended to be improv'd and refined by M.* Caſſegrain.

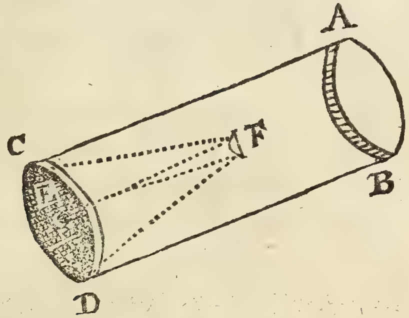
That the Reader may be enabled the better to Judge of the whole, by comparing together the contrivances both of Mr. Newton *and* Mr. Caſſegrain; *it will be neceſſary, to borrow from the ſaid French* Memoire *what is there ſaid concerning them: which is as followes.*

I Send you, (ſaith M. de *Bercè* to the Publiſher of the *Memoire*,) the Copy of the Letter, which M. *Caſſagrain* hath written to me concerning the proportions of Sr. *Samuel Morelands* Trumpet. And as for the Teleſcope of Mr. *Newton* it hath as much ſurpriſed me, as the ſame Perſon, that hath found out the proportions of the Trumpet. For 'tis now about three months, that that perſon communicated to me the figure of a Teleſcope, which was almoſt like it, and which he had invented; but which I look upon as more witty. I ſhall here give you the deſcription of it in ſhort.

ABCD. is a ſtrong Tube, in the bottom of which there is a great concave *Speculum* CD, pierced in the midle E.

F. is a convex *Speculum*, ſo diſpoſed, as to its convexity, that it reflects the *Species*, which it receives from the great *Speculum*, towards the hole E, where is an Eye-glaſs, which one looketh through.

The advantage, which I find in this Inſtrument above that of Mr. *Newton*, is firſt, that the mouth or aperture AB of the Tube may be of what bigneſs you pleaſe; and conſequently you may have many more rays upon the Concave *Speculum*, than upon that, of which you have given us the deſcription. 2. The reflexion of the rays will be very natural, ſince it will be made upon the *axis* it ſelf, and therefore more vivid. 3. The viſion of it will be ſo much the more pleaſing, in that you ſhall not be incommoded by the great light, by reaſon of the bottom CD, which hideth the whole face. Beſides that you'l have leſs difficulty in diſcovering the Objects, than in that of Mr. *Newtons*.



So far this French Author. To which we ſhall now ſubjoin the Conſiderations of Mr. Newton, *as we received them from him in a Letter, written from* Cambridge *May* 4th 1672, *as follows.*

SIR

I Should be very glad to meet with any improvement of the Catadioptrical Teleſcope; but that deſign of it, which (as you informe me) Mr. *Caſſegrain* hath communicated 3 months ſince, and is now printed in one of the French *Memoires*, I fear will not anſwer Expectation. For, when I firſt applied myſelf to try the effects of Reflexions, Mr. *Gregory's Optica Promota* (printed in the year 1663) being fallen into my hands, where there is an Inſtrument (deſcribed pag. 94) like that of Monſieur *Caſſegrain's* with a hole in the midſt of the Object-Metal to tranſmit the Light to an Eye-glaſs placed behind it; I had thence an occaſion of conſidering that ſort of conſtructions, and found their diſadvantages ſo great, that I ſaw it neceſſary, before I attempted any thing in the Practique, to alter the deſign of them, and place the Eye glaſs at the ſide of the Tube rather than at the midle.

The diſadvantages of it you will underſtand by theſe particulars. 1. There will be more light loſt in the Metal by reflexion from the little convex *ſpeculum*, than from the Oval plane. For, it is an obvious obſervation, that Light is moſt copiouſly reflected from any ſubſtance when incident moſt obliquely. 2 The convex *Speculum* will not reflect the rays ſo truly as the oval plane, unleſs it be of an Hyperbolique figure; which is incomparably more difficult to forme than a plane; and if truly formed, yet would only reflect thoſe rays truly, which reſpect the *axis*. 3 The errours of the ſaid convex will be much augmented by the too great diſtance, through which the rays, reflected from it, muſt paſs before their arrival at the Eye-glaſs. For which reaſon I find it convenient to make the Tube no wider than is neceſſary, that the Eye glaſs be placed as near to the Oval plane, as is poſſible, without obſtructing any uſeful light in its paſſage to the object metal. 4. The errors of the object-metal will be more augmented by reflexion from the convex than from the plane, becauſe of the inclination or deflexion of the convex on all ſides from the points, on which every ray ought to be incident. 5. For theſe reaſons there is requiſite an extraordinary exactneſs in the figure of the little convex, whereas I find by experience, that it is much more difficult to communicate an exact figure to ſuch ſmall pieces of Metal, than to thoſe that are greater. 6 Becauſe the errors at the perimeter of the concave Object-Metal, cauſed by the Sphericalneſs of its figure, are much augmented by the convex, it will not with diſtinctneſs bear ſo large an aperture, as in the other conſtruction. 7. By reaſon that the little convex conduces very much to the magnifying virtue of the inſtrument, which the Oval plane doth not, it will magnify much more in proportion to the Sphere, on which the great concave is ground, than in the other deſign; And ſo magnifying Objects much more than it ought to do in proportion to its aperture, it muſt repreſent them very obſcure and dark; and not only ſo, but alſo confuſed by reaſon of its being overcharged. Nor is there any convenient remedy for this. For, if the little convex be made of a larger Sphere, that will cauſe a greater inconvenience by intercepting too many of the beſt rayes; or, if the Charge of the Eye-glaſs be made ſo much ſhallower as is neceſſary, the angle of viſion will thereby become ſo little, that it will be very difficult and troubleſome to find an object, and of that object, when found, there will be but a very ſmall part ſeen at once.

By this you may perceive, that the three advantages, which Monſieur *Caſſegrain* propounds to himſelf, are rather diſadvantages. For, according to his deſign, the aperture of the inſtrument will be but ſmall, the object dark and confuſed, and alſo difficult to be found. Nor do I ſee, why the reflexion is more upon the ſame *axis*, and ſo more natural in one caſe than in the other: ſince the *axis* it ſelf is reflected towards the Eye by the Oval plain; and the Eye may be defended from external light as well at the ſide, as at the bottome of the Tube.

You ſee therefore, that the advantages of this deſign are none, but the diſadvantages ſo great and unavoidable, that I fear it will never be put in practiſe with good effect. And when I conſider, that by reaſon of its reſemblance with other Teleſcopes it is ſomething more obvious than the other construction; I am apt to believe, that thoſe, who have attempted any thing in Catoptricks, have ever tryed it in the firſt place, and that their bad ſucceſs in that attempt hath been the cauſe, why nothing hath been done in reflexions. For, Mr. *Gregory*, ſpeaking of theſe inſtruments in the aforeſaid book pag 95, ſayeth; *De mechanica horum ſpeculorum & lentium, ab aliis fruſtrà tentatâ, ego in mechanicis minus verſatus nihil dico.* So that there have been tryals made of theſe Teleſcopes, but yet in vain. And I am informed, that about 7 or 8 years ſince, Mr. *Gregory* himſelf, at *London*, cauſed one of ſix foot to be made by Mr. *Reive*, which I take to have been according to the aforeſaid deſign deſcribed in his book; becauſe, though made by a skilful Artiſt, yet it was without ſucceſs.

I could wiſh therefore, Mr. *Caſſegrain* had tryed his deſign before he divulged it: But if, for further ſatisfaction, he pleaſe hereafter to try it, I believe the ſucceſs will inform him, that ſuch projects are of little moment till they be put in practiſe.

Some Experiments propos'd in relation to Mr. Newtons *Theory of light, printed in* Numb. 80; *together with the Obſervations made thereupon by the Author of that Theory; communicated in a Letter of his from* Cambridge, *April* 13. 1672.

I. TO contract the beams of the Sun without the hole of the window, and to place the priſm between the focus of the *Lens* and the hole, ſpoken of in M. *Newtons* theory of light,

II. To cover over both Ends of the Priſm with paper at ſeveral diſtances from the middle; or with moveable rings, to ſee, how that will vary or divide the length of the figure, inſiſted upon in the ſaid Theory.

III. To move the Priſm ſo, as the End may turn about the middle being ſteady.

IV. To move the priſm by ſhoving it, till firſt the one ſide, than the midle, than the other ſide paſs over the hole, obſerving the ſame Paralleliſm.

The Obſervations, made upon theſe propoſals.

I Suppoſe the deſign of the Propoſer of theſe Experiments is, to have their events expreſſed, with ſuch obſervations as may occur concerning them. 1. Touching the *firſt*, I have obſerv'd, that the Solar image falling on a paper placed at the *focus* of the *Lens*, was by the interpoſed Priſm drawn out in length proportional to the Priſms reflexion or diſtance from that *focus*. And the chief obſervable here, which I remember, was, that the Streight edges of the oblong image were diſtincter than they would have been without the *Lens*.

Conſidering that the rays coming from the Planet *Venus* are much leſs inclined one to another, than thoſe, which come from the oppoſite parts of the Suns diſque; I once tryed an experiment or two with *her* light. And to make it ſufficiently ſtrong, I found it neceſſary to collect it firſt by a broad *lens*, and then interpoſing a Priſm between the *lens* and its *focus* at ſuch diſtance, that all the light might paſs through the Priſm; I found the *focus*, which before appeared like a lucid point, to be drawn out into a long ſplendid line by the Priſms reflexion. I have ſometimes deſigned to try, how a fixt *S*tar, ſeen through a long Teleſcope, would appear by interpoſing a Priſm between the Teleſcope and my eye. But by the appearance of *Venus*, viewed with my naked eye through a Priſm, I preſage the event.

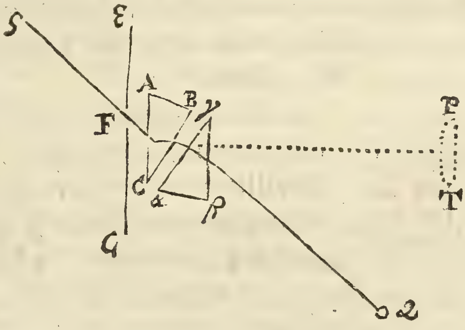
2. Concerning the *ſecond* experiment, I have occaſionally obſerved, that by covering both ends of the Priſm with Paper at ſeveral diſtances from the midle, the breadth of the Solar image will be increaſed or diminiſhed as much, as is the aper-

ture of the Priſm without any variation of the length: Or, if the aperture be augmented on all ſides, the image on all ſides will be ſo much and no more augmented.

3. Of the *third* experiment I have occaſion to ſpeak in my anſwer to another perſon; where you'l find the effects of two Priſms in all croſs poſitions of one to another deſcribed. But if one Priſm alone be turned about, the coloured image will only be tranſlated from place to place, deſcribing a circle or ſome other Conick Section on the wall, on which it is projected, without ſuffering any alteration in its ſhape, unleſs ſuch as may ariſe from the obliquity of the wall or caſual change of the Priſms obliquity to the Suns rays.

4. The effect of the *fourth* experiment I have already inſinuated telling you (in pag. 3076 of the *Tranſactions*) that Light, paſſing through parts of the Priſm of divers thickneſſes, did ſtill exhibit the ſame Phænomena.

Note, that the long *axes* of the two Priſms in the experiment deſcribed in the ſaid pag. 3076 of the *Tranſactions*, were parallel one to another. And for the reſt of their poſition, you will beſt apprehend it by this Scheme; where let EG deſign the window; F the hole in it, through which the light arrives at the Priſms; ABC the *firſt* Priſm, which refracts the light towards PT, painting there the colour in an oblong form; and $\alpha\beta\gamma$ the *ſecond* Priſm, which refracts back again the rays to Q where the long image PT is contracted into a round one.



The plane $\alpha\gamma$ to BC, and $\beta\gamma$ to AC, I ſuppoſe parallel, that the rays may be equally refracted contrary ways in both Priſms. And the Priſms muſt be placed very near to one another; For if their diſtance be ſo great, that colours begin to appear in the light before its incidence on the ſecond Priſm, thoſe colours will not be deſtroyed by the contrary refractions of that Priſm.

Theſe things being obſerved, the round image Q will appear of the ſame bigneſs, which it doth when both the Priſms are taken away, that the light may paſs directly towards Q from the hole without any refraction at all. And its diameter will equal the breadth of the long image PT, if thoſe images be equally diſtant from the Priſms.

If an accurate conſideration of theſe refractions be deſigned, it is convenient, that a *Lens* be placed in the hole F, or immediately after the Priſms, ſo that its *focus* be at the image Q or PT. For; thereby the Perimeter of the image Q and the ſtraight ſides of the image PT will become much better defined than otherwiſe.

An Account of a Stone cut out from under the tongue of a Man; lately ſent in a Letter of Mr. Liſters *to his Graſe the* Lord Arch-Biſhop *of* York.

May it pleaſe your Grace,

IN obedience to your Grace's Commands, I have penned the Circumſtances of a not common Medical obſervation, viz. the Exciſion of *a ſtone* from under the tongue. And I here with preſent your Grace alſo with the ſtone its ſelf, as I had it from the perſon it was taken.*

As to the occaſion and time of its birth, he tels me, (My Lord, you may be pleas'd to give firm Credit to every particular, that he hath anſwered me at your Grace's inſtance) it was from a winter Sea-voyage, which laſted much longer than he expected, and wherein he ſuffered an exceeding cold; and that, not long after his landing, he found a certain *Nodus* or hard lump in the very place whence this ſtone was cut. There was about 8 years betwixt its breading and being taken away.

As to its growth, and the inconveniences thence enſuing; he further ſaith, that upon all freſh-cold-taking, he ſuffered much pain in that part eſpecially; and yet, that cold once being over, that part was no more painful than the reſt of his mouth. He adds, that towards the *7th* and *8th* year it did often cauſe ſud-

den

* *This Stone is now in the cuſtody of the* R. Society, *to whom it was preſented afterwards.*

ſudden ſwellings in all the Glanduls about the mouth and throat upon the firſt draught of beer at meals; which yet would in a ſhort time fall again.

Laſtly, as to the particulars remarkable at the time of its being taken away, he relates; That it began its work with a ſudden *vertigo*; which vertiginous diſpoſition continued more or leſs from Spring 'till Auguſt; in which month, without any prævious cauſe ſave riding, the place where it was lodged ſuddainly ſwelled, and ran purulent matter at the aperture of the *ductus Whartonianus*: that it ſuddainly ſtopped of its runing (which he cannot attribute to any thing but Cold,) and ſwelled with a great inflammation, and very great danger of choaking; it being ſcarce credible, what pain the party ſuffered in endeavouring to ſwallow even beer, or any liquid thing.

This extremity laſted 5 days, in all which time, the party had ſo vaſt a flux of ſpittle runing from him, that it was not poſſible for him to repoſe his head to ſleep, without wetting all the bed about him; inſomuch as that it was very much queſtioned by ſome friendly viſitants, whether he had not of himſelf, or by miſtake, made uſe of ſome Mercurial medicine.

The varieties or degrees of this *ſpontaneous ſalivation* were ſuch, that he urged me not to omit them in the relation I was to make to your Grace, as thinking them very notable.

The firſt day, the *ſaliva* ran thin and tranſparent, almoſt like water without any bubles. The 2 day it ran frothy; it taſted ſalt, (which yet he is apt to think hot rather than really ſalt, becauſe that day the inflammation was at the height). The 3 day it roaped exceedingly; on which day a ſmall pin-hole broak directly over the place of the Stone and ran with purulent matter as formerly. The 4 day the *ſaliva* ran *inſipid*, ſenſibly cold in the mouth; (which again confirms me in that opinion, that the former ſharp taſt was the effect of heat, and not the immediate quality of a ſalt humour;) very little frothy. The 5 day (which was the day of the inciſion,) it ran as on the *4th* but left an extream claimineſs on the teeth, inſomuch that they often clave together, as though they had been joyned together with glue.

Upon the inciſion, which proved not wide enough, the membranes or baggs, wherein the Stone lay, came away firſt. As to the Stone it ſelf, it was ſo hard as to endure the *forcipes* in drawing it forth: it was covered over with graſſ green matter, which ſoon dryed, and left the ſtone of a whitiſh colour, as it is to be ſeen. It is but light in proportion to its bulk, weighing about 7 grains; and 'tis much of the ſhape of our ordinary horſe-beans. There are viſible impreſſions upon it of ſome Capillary and ſmall veſſels, it was bred amongſt. Laſtly, it is ſcabrous or rough, ſand-like, although the ſubſtance is Tophaceous.

The Accidents accompaning the working away of this Stone, (for the inciſion was meerly obſtetrical,) and the place of its birth give occaſion to call the diſtemper a *Ranula.* Yet in truth this was nothing elſe but one of thoſe Tumours called *Atheroma*; and therefore we will name it *lapis Atheromatis.*

An Extract of a Letter *of the ſame Mr.* Liſter, *written from* York *April* 12. 1672, *concerning* animated Horſe-hairs; *rectifying a Vulgar Error.*

*S*ir,

I Cannot diſcover any thing new and rare in natural Philoſophy, but I muſt forthwith make you participate of my good fortune; and I aſſure you, the relation, I am about to make you, is of a thing very ſurpriſing.

It hath been credibly reported, that *Horſe hairs* thrown into water will be animated; and yet I ſhall ſhew you by an unqueſtionable obſervation, that ſuch things as are vulgarly thought animated Hairs are very Inſects, nouriſhed within the bodies of other Inſects, even as *Ichneumones* are within the bodies of Caterpillars.

I will premiſe the particulars concerning this Animal, as I find them collected by the Induſtry of *Aldrovandus*, and ſave you the trouble of that voluminous Author.

This Inſect (ſaith he) ſeems to have been unknown to the Ancients; as it is called by the moderns *ſeta aquatica* or *vermis ſetarius*, either from the moſt ſlender figure of the body; or becauſe it is thought to be generated of an horſe-hair putrifying in water. The Germans call them by a name rendred *Vituli aquatici.*

It is bred in corrupt waters; perhaps of horſe-hair, for (ſaith *Albertus* upon his own frequent trial, as I find him quoted by *Aldrovandus*,) theſe hairs, put into ſtanding water, move and are inamated, or, as he words it, *vitam & ſpiritum accipiunt, & moven-*

tur. Others have thought them to have their birth from weeds hanging down from the banks into ponds and Rivers. Others from Locuſts and Graſhoppers (*ex Bruchis ;*) which laſt though it be near the matter, yet it is rejected by *Aldrovandus* himſelf, as the moſt unlikely.

They have been found in a cold and good ſpring, and elſewhere, (which is a wonder, ſaith *Aldrovandus* ,) upon a leafe in a Garden. And this, which was there found, was 5 or 6 fingers-breadth long; the thickneſs of a briſtle Horſe-hair, with a duskiſh back, and a white belly; and the tail on every ſide white.

I ſaw (ſaith *Aldrovandus*) a black one thicker than the whitiſh one. Other Authors otherwiſe deſcribe them, as *Bertrutius*, *Albertus*, *&c.* Some affirming them to have been a cubit long; others, two cubits, others, 9 inches long at the leaſt: that they are white of colour, and ſo hard as ſcarce to be cruſhed with ones foot: to be every where of the ſame thickneſs: that they move not as wormes move, but *ſnake-like*, and knit themſelves up into knots: that their skin is one continued thing without Inciſures; and therefore ſome would exclude them from the inſect-kind: that they have no head, but ſwim both waies, and therefore may be called *amphiſbæna aquatica:* that they are poyſon, drunk down into the ſtomack, but not venom to the touch.

And thus much out of *Aldrovandus* concerning the name of this Inſect, the place of its birth and original, the place where they are to be found, its deſcription, different ſpecies, nature, poyſon &c.

Our obſervation is this. *April.* 2. there was thrown up out of the ground of my Garden, in digging amongſt other things of this nature, a certain cole-black Beetle of a midle ſize, and flat ſhape, and which I have obſerved elſewhere common enough. Theſe Beetles I diſſected upon the account of ſome curioſity, wherein I had a mind to ſatisfy myſelf. But I was ſurpriſed to find in their ſwollen bellies of theſe *Hair-wormes*, in ſome three, in others but one only. Theſe particulars we carefully noted: 1. That upon the inciſion they crawl'd forth of themſelves. 2. That putting them into water, they lived in it many daies, and did ſeem to endeavour to eſcape by lifting up their heads out of the water, and faſtning them to the ſide of the veſſels; very plainly drawing the reſt of their body forward. 3. That they cannot be ſaid to be *amphiſbæna*, but do move forward only by the head, which is fairly diſtinguiſhable from the tail by a notable blackneſs. 4 That the three, I took out of the body of one Beetle, were all of a dark hair-colour with whitiſh bellies, ſomewhat thicker then hoggs briſtles; but I took out of the body of another beetle one that was much thicker than the reſt; much lighter coloured; and by meaſure juſt five Inches and a half long; whereas all the reſt did not exceed three inches three quarters.

An Extract of a Letter, written March 5. 1672 *by Dr.* Thomas Corneiio, *a* Neapolitan *Philoſopher and Phyſician, to* John Dodington *Eſquire, his* Majeſties *R*eſident *at* Venice; *concerning ſome Obſervations made of perſons pretending to be ſtung by* Tarantula's: *Engliſh'd out of the Italian.*

SIR

NOw the time approaches, that I may ſend you ſome *Tarantulas*. Mean while I ſhall not omit to impart unto you, what was related to me, a few daies ſince, by a judicious and unprejudicate perſon, which is; That being in the Country of *Otranto* (where thoſe Inſects are in great numbers,) there was a man, who thinking himſelf ſtung by a *Tarantula*, ſhew'd in his neck a ſmall ſpeck, about which in a very ſhort time there aroſe ſome pimples full of a ſerous humour, and that, in a few hours after, that poor man was ſorely afflicted with very violent ſymptoms, as *Syncope's*, very great agitations, giddines of the head, and vomit; but that without any inclination at all to dance, and without all deſire of having any muſical inſtruments, he miſerably dyed within two daies.

The ſame perſon affirm'd to me, that all thoſe that think themſelves bitten by *Tarantula's*, (except ſuch, as for ſome ends fain themſelves to be ſo,) are for the moſt part young wanton girles, (whom the Italian writer calls *Dolci di ſale*,) who by ſome particular indiſpoſition falling into this melancholly madneſs, perſwade themſelves according to the vulgar prejudice, to have been ſtung by a *Tarantula*. And I remember to have obſerved in *Calabria* ſome women, who ſeiſed on by ſome ſuch accidents were counted to be poſſeſs'd with the Divel; it being the common belief in that Province, that the greateſt part of the evils, which afflict man-kind, proceeds from evil Spirits.

This brings to my mind a terrible evil, which often enough is obſerv'd in *Calabria*, and is call'd in their language *Coccio maligno*. It ariſeth on the ſurface of the body, in the form of a ſmall ſpeck, of the bignes of a lupin. It cauſeth ſome pain, and if it grow not ſoon red thereupon, it in a very ſhort time certainly kills. 'Tis the common opinion of thoſe people, that ſuch a diſtemper befals thoſe only, that have eaten fleſh of Animals dead of themſelves: which opinion I can from experience affirm to be falſe. So it frequently falls out, that of many ſtrang effects, we daily meet with, the true cauſe not being known, ſuch an one is aſſigned, which is grounded upon ſome vulgar prejudice. And of this kind I eſteem to be the vulgar belief of the cauſe of that diſtemper, which appears in thoſe that think themſelves ſtung by *Tarantulas*.

But why ſhould not we rather think, that that diſtemper is cauſed by an inward diſpoſition, like that vvhich in ſome places of *Germany* is vvont to produce that evil, vvhich they call *Chorea Sti Viti*, St. Vite's dance. But of this I hope I ſhall ſoon be able to vvrite my thoughts more fully, vvhich vvill, I think, be ſufficient to refute that fable of the *Tarantula*.

An Account of the Aponenſian Baths *near* Padua; *communicated by the forementiond Inquiſitive Gentleman*, *Mr.* Dodington, *in a Letter written to the Publiſher from* Venice March 18. 1672.

SIR,

IN the Obſervations and Hiſtory of Nature poſſibly this may not be unvvorthy the notice. Five miles from *Padua* are the vvaters, call'd *Aponenſia*, from a tovvn called *Aponum*, famous in antiquity, and among others frequently mention'd by *Livy*. I vvill not doubt, but that Sr. I.F. and D B. two worthy members of the *R. Society* and who lived long in *Padova*, have inform'd themſelves moſt exactly of what ever I ſhall be able to ſay on this Subject; however I do not ſcruple to give you a ſhort relation of it.

The waters are actually very hot. Secondly, they are ſtinking. Thirdly, they yield a great deal of very fine ſalt; of which the natives ſerve themſelves in their ordinary occaſions. This ſalt is the thing, I think moſt conſiderable there. It is gather'd in this manner: The Natives, after Sun ſet, ſtirr peices of wood in the water, and preſently the Salt ſticks to them, and comes off in ſmall flakes, exceeding white, and very ſalt. This never looſeth its ſavour. The people there, with the ſame water uſe to waſh their wales,to render them whiter then ordinary; which it doth even whiter than lime. Such wales conſerve their ſaltneſs ſome few daies only,and then become inſipid,even though they ſwet forth a white excreſcence in thin and light flakes like niter,many years after. But that Salt, which is collected from the ſtones, gravel and earth, by which the rivolets, deſcending from thoſe Baths, do run, is without any taſt of Salt; though there be no difference in the form or colour from that which is gather'd with the wooden inſtruments,by me mentioned. This is the Sum of what I have to ſay at preſent of this particular. If you think the matter *tanti*,I will ſend you a more ample deſcription thereof, with my thoughts upon it.

Reflections made by P. Franciſco Lana *S.J. upon an Obſervation of Signor M.* Antonio Caſtagna,*Super intendent of ſome mines in Italy, concerning the formation of Cryſtals: Engliſh'd out of the* XI. Venetian Giornale de Letterati.

IN the laſt month of *September*, being arrived in the *Val Sabbia* into a place call'd le *Mezzane*, where I knew that thoſe Cryſtals are generated,I obſerv'd in a ſpacious round of a Meddow, ſeated on a hillock, ſome narrow places bare of all herbs, in which alone, and no where elſe thereabout, thoſe Cryſtals are produced, being all ſex-angular, both points of them terminating in a pyramidal figure, ſex-angular likewiſe.

I was told, that they were produced from the dews, becauſe (forſooth!) being gather'd over night,the next morning there would be found others at ſuch a time only, when it was a ſerene and dewy sky;and that upon the herbs of the meddow,and without the bounds of thoſe bare and ſterile places never any Cryſtals were to be found; beſides, that the ground having been in ſome places bared of all greens, and reduced to the condition of thoſe other naked places, yet no cryſtals were ever ſeen to have been form'd there. But I, when I had examined, that in the neighbour-hood of that hill there was no mark at all of any Mines, did conclude,that it might be a plenty of nitrous ſteames, which might withal hinder vegetation in thoſe places, and coagulate the Dew falling thereon. And that thoſe exhalations were rather Nitrous, than of an other kind, I was induced to believe, becauſe *Niter* is not only the natural *coagulum* of water, as is manifeſt in artificial glaciations; but alſo it ever retains the above ſaid ſex-angular figure, altogether like that of thoſe Cryſtals. Which may alſo be the very cauſe of the ſex-angular figure in *Snow*; this being nothing elſe but water concreted by its natural *coagulum*, which is a nitrous exhalation. And to make it yet more manifeſt, that theſe are indeed expirations of niter, I digg'd up ſome of the earth, and drew a Salt from it, which had both the taſt and figure of Niter; though ſome grains of it were of a ſquare, others of a pyramidal, figure.

It therefore ought not to be affirm'd, that a dewy vapour is of it ſelf able to be form'd into a ſolid gem; becauſe, if that were ſo, ſuch vapours being eaſily carried by any motion of the Air from thoſe narrow places, and falling down in dew far from the ſame, Cryſtals would be formed in thoſe other places; but they are only form'd there: Whence we may very probably inferr, that thence are raiſed the exhalations, which do concrete the dew; after ſuch a manner as the vapour or exhalation of Lead coagulates Quickſilver.

A Relation of an Inland-Sea, near Danzick, *yeilding at a certain ſeaſon of the year a green ſubſtance, which cauſeth certain death; together with an Obſervation about white Amber: Communicated by Mr.* Kirkby, *in a Letter written to the Publiſher from* Danzick Decemb. 19. 1671.

NEar a ſmall village, call'd *Tuckum*, 2½ German miles diſtant from this Citty weſt-ward, there is an Inland-Sea (made by the meeting of three rivolets, ſome ſprings from the adjoyning hillocks, and the deſcending rain and ſnow-water,) of about half a German mile long and an eight part of ſuch a mile broad. It ſtretches *NNW* and *SSW*. About the midle of the bow on the Eaſt-ſide it diſchargeth it ſelf with a pretty ſtream; as it alſo doth in another place more Southerly. The ſoil of the ground round about ſeems to be ſand mixt with clay. Its ſhore generally ſandy, as is its bottom alſo. Its depth, where deepeſt, four fathoms; but for the moſt part but one, or one fathom and an half. 'Tis ſtored with wholeſome and delicate Fiſh, as Pearch, Roch, Eles, &c. and famed for a ſmall fiſh, much eſteem'd here, and not much unlike a Pearch; only not ſo party coloured, and having a larger head proportionable to its body, call'd the Cole-pearch. The water ſvveet and vvholeſome; but only in the three Summer months, June, July, and Auguſt, it becoms every year, during the dry weather, green in the midle vvith an hairy effloreſcence; vvhich green ſubſtance, being by ſome violent vvind forced a ſhore, and vvith the vvater drunk by any Cattel, Dog, or Poultry, cauſeth certain and ſudden death; whereas at the ſame time, that a knovving and ingenuous perſon (vvho firſt acquainted me vvith it,) ſavv three dogs killed vvith it, the Horſes that vvere ridden into the vvater *beyond* the place, vvhere this green ſubſtance floated, drunk vvithout any hurt; and that alſo, during the ſame ſeaſon, the vvater in the ſtreams, that flovv from it, are vvholeſome. I ſhall endeavour, if you deſire it, to procure ſome of that ſtuff, and get it examin'd by a chymical analyſis.

One thing more I muſt add, that the chief Fiſher here inform'd me, that tvvo or three years ago fiſhing in this Sea, his net brought up a conſiderable large piece of vvhite Amber, vvhich as a rarity he preſented to one of the chief Fathers of the Olive's Abby, to vvhich this Sea belongs. Novv ſince this Sea is not to be ſuſpected to come from the Ocean, it lying ſo high, and about three German Miles diſtant from the Ocean; and ſince alſo the neighbouring woods that bear none, but highly reſinous trees, cannot be reaſonably ſaid to furniſh ſuch Amber, that conjecture, which imports that Amber is a bituminous fluid ſubſtance, hardned by the operations of the aqu-aerial particles upon it, may receive ſome confirmation from this account.

An Account of ſome BOOKS.

I. *De ANIMA BRUTORUM Exercitationes duæ; prior PHYSIOLOGICA, altera PATHOLOGICA, Auth.* Thoma Willis *M.D. Philoſ.Natur.Prof. Sidlej.* Oxon. *nec non Med. Coll.Lond. & Soc.Reg.Socii.* Oxonii, *A.* 1672. *in* 4°.

WHat the Learned Author of this difficult Argument had heretofore promiſed, he now in this Book with much care performeth; which is the *Pathology of the Brain*, and *the Nervous kind*, explicating the Diſeaſes that affect it, and teaching their Cures; together with ſome previous Phyſiological Conſiderations of the *Soule of Brutes*.

And becauſe it may, by ſome, be thought ſomewhat paradoxical, that he aſſigneth to that Soul, whereby both Brutes and Men have life, ſenſe, and local motion, not only extenſion, and as 'twere Organical parts, but alſo peculiar Diſeaſes, and appropriate Cures; and becauſe alſo he diſtinguiſhes this meerly vital and Senſitive Soul from the Rational, to which he makes it ſubordinate, and ſo maketh man a Double-ſoul'd Animal; he maketh it firſt of all his buſineſs to clear theſe matters, and to free them from what may ſeem offenſive in them.

In the doing of this he denieth not the Corporeity of the Brutal Soul, eſteeming, that both by conſiderable Arguments, and by very ample, ancient and modern, Suffrages, the ſame may be evinced; and beſides, that its *Bipartition* is by a neceſſary conſequence deducible from the *flammeous* Life of the *Bloud*, and the *lucid* or Æthereal ſubſtance of the *Animal Spirits*; both which he hath formerly aſſerted, and endeavoured to prove. For, if it be granted him, that the *Vital* portion of this Soul, lodging in the Bloud, be a kind of Fire, and the *Senſitive* part be nothing but an Aggregate of Animal Spirits, diffuſed all over in the Brain and Nerves; he draws this conſequence, That the Soul of a Brute, co-extended to the whole Body, hath not only many and diſtinct, but alſo ſomewhat diſſimilar, parts. And if it be objected, that the Soul of a Brute is immaterial, becauſe it perceiveth, or is aware that it feels, Matter ſeeming incapable of Perception; he

anſwers,

anſwers, That that would be very probable, if that Perception did exceed the bounds of things material, and were of a higher pitch, then what is generally aſcribed to Natural Inſtinct, or *Idioſyncraſis:* Adding, that none is like to undertake to prove, that the Omnipotent Maker, and Firſt Mover, and Conſtant Governour of all things ſhould not be able to impreſs ſuch powers upon Matter, as might be proper and ſufficient to perform the functions of the Senſitive life.

And as to what he further aſſerts, That ſome people are more, yea ſooner and rather ſick in their Soul, than in their Body; (whereas Phyſitians do commonly in Schools refer the principal Seats of all Diſeaſes to the ſolid parts, and the humors, and vital ſpirits;) in this he ſpeaketh conſonantly to his *Hypotheſis:* For, ſince that that Soul hath a material Being co-extended to the Body, and peculiar parts, powers and affections, he rationally concludeth, that it is ſubject alſo to preternatural affections, and frequently needs the Phyſitians aid.

Beſides, he eſteems to have made it out in his *Pathology*, That the Corporeal Soul extends her Diſeaſes not only to the Body, but alſo to the *Mind* or the Rational Soul, and often involves the ſame in her defects and perturbations.

Moreover, he thinks to have alſo proved from reaſon and authority, That there are in Man two diſtinct Souls, ſubordinately; and eſteems this opinion to be ſo far from being Heretical or pernicious, that on the contrary he hopes, it will prove altogether Orthodox, and conducive to a good life, and a powerful confutation of Atheiſm.

But to the end that the Author might the better inform his Reader of the Corporeal Nature, and the *flammeous* and *lucid* parts, and the affections of the ſame, he found it neceſſary *both* to deſcribe the vital Organs of divers Animals, by whoſe operation the Lamp of Life is maintained; and to repreſent alſo the Brains of thoſe they call perfect Brutes, and of Man, diſcovered by him as to their inmoſt receſſes, and their ſecret and ſmalleſt *ductus's*. By which manifold and comparative Anatomy, as the manifold and wonderful wiſdom of the Creatour is manifeſted; ſo are by the ſame diſcovered, even in the ſmalleſt and moſt deſpicable Animals, not only mouths and limbs, but alſo hearts, being as 'twere ſo many altars and hearths to perpetuate this vital flame. Here the Reader will meet with very skilful and accurate Diſſections of the *Silk-worm*, *Oyſter*, *Lobſter*, *Earth-worm*; as alſo of divers Brains; and *firſt*, of that of a *Sheep*, in a manner excarnated, to make the Medullar ſtreaks, and its inmoſt fabrick to be ſeen: And *ſecondly*, of a new one of an *Humane* Brain; where, a Section being made through the *falx*, the *Corpus calloſum* and the *Fornix*, and their parts diſplayed and orderly laid open, are exhibited the ſtreaked bodies, as alſo the Optick and Orbicular prominencies, *&c.* That ſo by confronting theſe Brains, the vaſt difference of the Soul of a Brute and that of a Man may the better be ſhewn.

Concerning the *Pathology* of this Author, he confeſſeth, that in delivering the Theories of Diſeaſes he hath relinquiſh'd the Old way, and produced moſtly new *Hypotheſes*; which being founded and eſtabliſhed upon true Anatomical Obſervations, give a better account of the *Phænomena* of the ſick, indicate more aptly the cauſes of ſymptoms, and ſuggeſt properer waies of curing them. But as to Remedies and his Therapeutical Method, though therein he doth not with others ſcrupulouſly inſiſt in the footſteps of the Ancients; yet he rejects nothing that hath been ſetled by ſober Authority, and by long Experience; adding thereunto many things invented by late Experience, and by Analogy. All which he hopes will prove uſeful both for improving Medical knowledge, and the happier curing the Diſeaſes of the Head; which he enumerates, and diſcourſes upon, both as a Naturaliſt and a Phyſitian.

II. *Suite des nouvelles Experiences ſur la VIPERE, avec une Diſſertation ſur ſon VENIN; par* Moyſe Charas. *A* Paris 1671, *in* 8°.

This is a Sequel of Experiments, made by the skill and induſtry of the ſame, that was the Author of the Tract, entituled *Nouvelles Experiences ſur la Vipere*, formerly deſcribed in *Numb.* 54. and ſince Engliſh'd out of French, and printed by Mr. *Martyn* at the Bell in *Pauls Church-yard*. It is made by the Author in his own defence againſt a Letter of Signor *Redi*, publiſht in Italian againſt ſome Experiments of the Author's former Book, and deſcribed in *Numb.* 57. In it M. *Charas* expreſſeth, that he is ſo far from changing his opinion upon his examining

Signor

Signor *Redi's* Letter, that he is much more confirmed in it.

The Controverſie conſiſts chiefly in this: 1. That Signor *Redi* will have the Jellow liquor contain'd in the bags of the Teeth-gum of Vipers to be the only and true ſeat of their Venom. 2. That this liquor is indeed not Venomous being taken at the mouth, but only when let into a wound, made either by the live Animal, or even by a dead ones teeth, thruſt into ones fleſh after it is dead. 3. That the ſame Juice drawn from a dead Viper, as well as from a live one, is alwaies venomous, if it paſs into a wound and mingle with the bloud of the wounded Animal, whether it be liquid, or dried to powder. 4. That it kills generally all ſorts of Animals being wounded, and receiving of this liquor into the wound. Whereas M. *Charas* aſſerts, 1. That the Venom of Vipers is only in the enraged Spirits. 2. That the Jellow liquor, as well of a live and even a much angred Viper, as of a dead one, hath no Venom at all in it, neither in the biting, nor when taken inwardly, nor let into a wound and mixt with the bloud, nor any other way; and conſequently that it kills and infects no kinds of Animals, but is a pure and very innocent *Saliva*.

To make good theſe aſſertions, M. *Chartas* affirms to have made new Experiments, in the preſence of two or three hundred perſons, Phyſicians and others, capable to Judge, and of great veracity; and to have found abundant cauſe to adhere to the reſult, he had made from his former tryals, *viz.* That never any one Animal of all thoſe, he wounded, died of the jellow liquor let into the wounds, though drawn hot from the bags of the gums of Vipers much enraged. Theſe Experiments are at length deſcribed in his Book.

If it be ſaid in favour of Signor *Redi*, That the diverſity of Climats, or of food alſo, may change the nature of Vipers, and cauſe that manifeſt difference between the Experiments; M. *Charas* anſwers, that it cannot be, That the nature of the Jellow liquor, and that of the Spirits ſhould be ſo quite changed; becauſe, that in *France* the ſame marks are found in the Jellow liquor with thoſe deſcribed of *Italy*, and that the French Vipers do, without an intervention of the ſaid liquor, kill as readily, as thoſe of Italy can do. And he adds, that he hath verified it by very many Experiments, That all the Vipers of France, though taken in very different places, and thoſe often diſtant from one another above an hundred and twenty Leagues, do all kill equally.

And, as to the bilious expirations of Vipers, which may intervene with the Jellow liquor and render it venomous, he ſaith, That that is nothing but the angred Spirits under a diſguiſe.

Now touching the enraged Spirits of Vipers, our Author, though he calls them Spiritual, or not Material, and maketh their Venom not viſible nor palpable, yet certainly he will be underſtood to ſpeak ſo in compariſon to the Jellow liquor, which is a *viſible* body; for, 'tis beyond all doubt, that thoſe irritated Spirits are corpuſcles, though not ſuch as may be ſeen and handled like the ſaid liquor, nor ſuch as you may aſſign a particular place to in the body of the Viper, where they lodge; though it may be ſaid, that being raiſed and ſevered either from the maſs of the bloud, or rather from the whole habit of the body, they rendevouze in the head, being ſtirred up by the concuſſion and great commotion, which the Viper feels in her whole body when vexed; whereupon follows an eagerneſs of being revenged for the ill done them, and then a quick and fiery action of the Spirits thus enraged. Nor can he mean, that theſe Spirits have neither place nor extenſion; for, how could they part from the Viper without having been in her body; and, how could they enter into the body of the Animal bitten without being there.

Further, to illuſtrate his notion of the Idea of the Viper for Revenge, he alledgeth the imagination of terrour by a Toad impreſſed in a Ferret, which having ſeen and been ſeen by that ugly Animal at a certain ſeaſon of the year, and that alwaies in Summer, cannot avoid running round about it, crying out aloud as if it call'd for ſuccour, whilſt the Toad remains unmov'd with its throat open, and being at length, by that imagination, forced to ſurrender it ſelf into that throat; as he affirms to have ſeen himſelf, and to have even kill'd the Toad at that very inſtant, and ſo ſaved the Ferret, which ran away. He alledgeth likewiſe a Mad Dog who can communicate his malignity to all ſorts of Animals, none excepted: And why not then Vipers, conveigh their angry Spirits into ſuch Animals as they meet with, and by them kill thoſe they have bitten? Which, he ſaith, they execute by the perturbation and corruption, they introduce in the whole maſs of bloud, foraſmuch as they obſtruct the circulation and communication of the natural Spirits through the body. He adds the example of Men, capable to cauſe a grangrene and death it ſelf by biting in choler; whereas no ſuch accident comes to paſs, when they chance to bite one without choler. He concludeth this diſcourſe with the ſting of a *Tarantula*, which he conceiveth to be accompanied with an imagination, ſo ſtrongly impreſſed in perſons that are ſtung by it, as that their Spirits are perverted, and made conform to the agitating nature of the ſame, and conſtrained at certain times by certain tunes to dance, and to return to ſuch motions every year. To confirm which, he relateth an example of a *Neapolitan* Souldier, who, he ſaith, hath been theſe four years in the *French* Infantry, and is ſtill in the Royal Regiment of *Rouſſillon*. This perſon never failed to feel every year at a determinate time (*viz.* about the 24*th.* of *July*) the effects of that ſting, which he had received before he came into *France*. And when the Idea's of the ſting were found exalted to a degree capable to produce their effects, he began to dance, and would hear without interruption the Violins, which the Officers of that Regiment cauſed to be play'd for him out of charity; to which he anſwer'd continually, keeping his time very well, without being tired, during three daies, eating and drinking without interrupting his dances, and being very impatient at any diſcontinuance of the play of the Violins. But on the fourth day his eagerneſs to dance abated, when he remembred all he had done, and knew all that were about him; after which time, he paſſed the reſt of the year without any inclination to dance. This Souldier, he ſaith, to have been ſeen thus to dance every year by thouſands of people, and particularly in the Camp Royal *A.* 1670, where the King himſelf, and the whole Court ſaw him.

Laſtly, M. *Charas* eſteems, that Signor *Redi* would do well, if, for the ſatisfaction of the Publick, without ſtanding up any longer for the venomouſneſs of the Jellow juice, which he thinks hath been ſo rationally conteſted with him, he would take the pains to look after ſome other thing, that might be common to the Vipers of *France* and *Italy*, and that might have the ſame diſpoſition of matter, the ſame power of acting nimbly, and deſerve to be equally declared to be the true ſeat of their Venom; that ſo Signor *Redi* might as validly exclude from it the enraged Spirits, as he (M. *Charas*) now does the Jellow liquor: But if he can find none ſuch, our Author thinks, he can have no ground to maintain his opinion, or contend againſt that of the vexed Spirits any longer.

III. *The* CHIRURGICAL *and* ANATOMICAL *Works of* Paul Barbette *M. D. Practitioner at* Amſterdam; *together with a Treatiſe of the* PLAGUE. *Engliſh'd out of* Low-Dutch. *London* 1672. *in* 8°.

THE ſkilful and diligent Author of this Book ſeems to have ſet down therein that Practice, which Reaſon and Experience, after a careful reading of the beſt Authors, and an exact Obſervation of ſeveral Operations, had taught him to be the ſafeſt, convenienteſt, and moſt eaſie. This he hath done in a few Chapters, rather inſerting in ſhort his Obſervations in the very deſcriptions of the *Diſeaſes*, than to waſte the Readers time with a prolix Diſcourſe; to the end he might not repeat in *particular* Diſeaſes, what he had firſt ſet down in *generals*.

Tumors, Wounds, and *Ulcers*, which neither in Cauſe nor Cure differ, he hath reduced under one head; contrary to what moſt Writers uſe to do, who only from the difference of the Part and Member affected difference the Diſeaſes, which afterwards, giving them new names, they multiply without any uſe; and ſo they render that Art, which is difficult enough of it ſelf, much more difficult.

Thoſe Medicaments, which he hath delivered in this Book, though they be few in number, yet are by ſome able Judges eſteem'd of great vertue; which the Author affirms to have found out by vaſt pains and no ſmall charges, and for the ſafety of which he alledgeth the confirmation of daily practice.

And becauſe *Anatomy* is the main foundation of *Chirurgery*, the Author hath thought good to annex ſo much of it, as may be neceſſary for the Art; of all which he ſhews the Uſes of it in the ſame.

He ſubjoyns alſo a ſmall Treatiſe of the *Plague*; diſcourſing of its Cauſes, Symptoms, Obſervations, and Cure; and illuſtrating all with divers ſelect Practical Obſervations.

IV. *The* AMERICAN PHYSITIAN; *or a Treatiſe of Roots, Plants, Trees, Shrubs, Fruit, Herbs,* &c. *growing in the* Engliſh *Plantations in* America: *whereunto is annexed a Diſcourſe of the* Cacao-nut-Tree, *and the uſe of its Fruit. By W.* Hughes. *London* 1672. *in* 12°.

Though the Author of this Tract do only promiſe in the Title of it to give an Account therein of the Vegetables growing in the *Engliſh* Plantations of *America*; (which is of good uſe, foraſmuch as it may make a part of the Univerſal Hiſtory of Nature, now more than ever laboured after by the generous Philoſophers of this Age;) yet he indeed performs more: ſince he preſents his Readers with ſeveral particulars, that are without the Sphere of the Vegetable Kingdom; ſuch as are the *White-Coral-Rocks*, to be found upon the Coaſt of Jamaica, as well as in other parts of America; the *Sea-ſtar-Fiſh*; the *Allegator*; the eaſy way of *making* good *Salt* in Jamaica: For the particulars of all which, we refer to the Book it ſelf.

ERRATA in Numb. 82.

Page 4051. line 17. read, *are* 1044, inſtead of, *are* 144. Ibid. l. 34. r. *and the other two*, inſtead of, 50 *of them.*

LONDON,

Printed for *John Martyn*, Printer to the *Royal Society*. 1672.

PHILOSOPHICAL TRANSACTIONS.

June 17. 1672.

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Additions to the Narrative publiſh't in Numb. 58. *about the Conjunction of the Ocean and Mediterranean by a Channel in France. A Letter of* P. Pardies, *containing ſome Animadverſions upon Mr.* Newton's *Theory of Light. An Anſwer of Mr.* Newton *to that Letter. Two Obſervations of Stones found, the* one *in the Bladder of a Dogg, the* other *faſtned to the Back-bone of a Horſe. An Account of ſome Books.* I. *An Eſſay about the Origin and Virtues of GEMS; by the Honourable* Robert Boyle *Eſquire.* II. Johannis Swammerdami *M.D. UTERI MULIEBRIS Fabrica, unà cum Methodo nova Cavitates corporis ita præparandi, ut ſuam ſemper genuinam faciem ſervent.* III. *Three Letters of* Johan. Dom. Caſſini, *concerning his Hypotheſis of the Suns motion, and his doctrine of Refractions.* IV. *Dr.* Richard Sharrocks *Hiſtory of the Propagation and Improvement of VEGETABLES, by the concurrence of Art and Nature: The Second Edition much enlarged.*

Some Additions to the Narrative, that was publiſh'd Numb. 58. *about the Conjunction of the Ocean and Mediterranean by a Channel in France; In which Additions the Progreſs and the deſigned Uſefulneſs of that great Undertaking are more amply repreſented: Out of a French Letter, written by Monſieur* de Froidour *to Monſieur* Barrillon, *and printed at* Tholouſe *this very year.*

IN the Deſcription of this Channel, inſerted in *Numb.* 58. of theſe *Tracts*, there was ſome mention made of the great *Magazin* of Water, for a continual ſupply in caſe of want thereof. This Store-houſe is more fully deſcribed in this Letter; where 'tis related, That it is in a Valley a little above the town of *Revel*, at St. *Feriol*; and that 'tis to be filled with the waters of the Rivolet *Audot*, and thoſe of Rain and Snow, that are wont to be very plentiful upon the *Black-mountain*. This Valley is very narrow at the beginning, large in the middle, and ſtreightened at the foot by the approach of two Rocky Hills, bounding it on both ſides; which, to make a Lake and to keep in the water, are conjoyn'd by a *Cauſey* of ſuch a height and thickneſs, that it may be call'd a third Hill. This *Cauſey* is 61 fathoms broad, and is to be 25 fathoms high, and 500 fath. long, to gain the Hills on both ſides. The *baſis* of this great work is a ſolid Body of Maſonry, laid, and every way encloſed within the rock. It hath only a ſmall Opening below in the form of a Vault, which is even with the ground, to ſerve for a paſſage to the water of this Magazin: This paſſage is 9 feet large, 12 feet high, and 94 fathoms long. Upon this Body of Maſonry, which by ſome fathoms exceeds the height of the ſaid Vault or Aqueduct, there is raiſed a thick Wall from the top of this Dam, down in a ſtreight line to the foot of it. This Wall incloſeth within its thickneſs another Vault, in the manner of a Gallery; the entry whereof, being at the foot of the Cauſey, is of the ſame heigth and breadth with the former. This Gallery anſwers directly, from the top of the Cauſey, to the Orifice of the Aqueduct, 5 fathoms above the ſurface of the ground, and it runs down along the ſide, and on the left hand of the Mouth thereof.

On this work there are built three thick Walls a croſs it, that go from one end of the Cauſey to the other, founded upon the Body of the Maſonry, and running into the work of the Gallery, which they traverſe croſs-wiſe. They are ancred and enchaſed, on the right and the left, in the rocks of the two skirts of the Valley. The *firſt* Wall, which is at the beginning of the Cauſey, is 12 feet thick at the end, being much broader below by reaſon of the *Talu* or ſlope: It is to be but 12 fathom high. The *ſecond*, to be more raiſed, is 3 fathoms thick, and 25 fathoms high: It ſtands very near in the midſt of the Cauſey, 33 fathoms diſtant from the firſt. The *third*, which maketh the foot of the Cauſey, and is 31 fathoms off from the ſecond, is 8 feet thick, and 15 fathoms high. The empty ſpace between the firſt and ſecond wall is to be filled with ſtones and earth well ramm'd together and made even, ſo that it may be cover'd with a bed of loam 6 feet thick, ſloping, and inſenſibly deſcending from the ſecond to the firſt Wall; that ſo the water, that ſhall be made to ſwell to the height of 20 to 25 fathoms, ſpreading it ſelf upon this *glacis* or ſlope, and to lean every where on its center, may not ſpoil the Cauſey. In the like manner is to be filled up the empty ſpace between the ſecond and third Wall, deſcending alſo ſlope-wiſe from the ſecond to the third, to ſerve for a buttreſs to the ſecond, that is to bear all the weight and force of the Water.

All theſe Walls, and even thoſe of the Gallery, are to be counter-walled by a Wall of two feet thickneſs. Beſides, the Gallery is to be counter-vaulted by another Vault; and the intermediate empty ſpaces are to be done up with a clayie earth well ramm'd; that ſo, in caſe that by any extraordinary accident the water ſhould come to make any gap in the loam-bed, that is between the firſt and ſecond wall, the reſt may by this means be preſerv'd entire.

In the firſt Wall there are Stones in toothings, from the top to the bottom, on the right and left of the Aqueducts mouth, and of the Galleries window: And this is to make a Cavity chamber-wiſe, four foot ſquare. The Wall of this little ſtructure is to be ſix feet thick, counter-walled with another Wall two feet thick, with a loam-bed between, to keep it ſafe. It ſhall end on the top above the Gallery, ſlope-wiſe

and

and like a Vault, which is likewiſe to be counter-walled and counter-vaulted with clay between. This walled ſquare Cavity is to be pierced by ſix or ſeven Metalline pipes, which ſhall be as big as thoſe of Canons, and have their Orifices from without; thereby to receive the water of the Magazin to the height of the Gallery. The Cocks are to be within, ſhut up in the little ſpace that the ſaid Cavity is to contain, for to caſt the water down ſo as it may have a fall of four fathoms. Theſe Cocks ſhall be open'd through a window that is at the end of the Gallery. And there is to be yet another little aperture beneath, at which one may deſcend into this Chamber, in caſe the paſſage of the water ſhall be incombred, or that any other inconvenience is to be remedied. For which purpoſe there ſhall be faſtned eight bars of Iron in the Walls, like a kind of ſtairs, for the conveniency of thoſe that ſhall go down.

This Gallery is only to ſerve for paſſing to open the Cocks, according as there ſhall be need of water: And the water falling down will find iſſue through the Aqueduct, following the bed of the rivolet *Audot*, falling into the Deriving Channel below the Village *Vaudreiil.*

It was neceſſary to place theſe Pipes ſo, as that they might not take the water but at about four fathoms high from the ground, becauſe 'tis not poſſible to make ſuch a great collection of waters in this Conſervatory, eſpecially of ſuch waters as come, in part, from Snows and Rains, without ſtore of dirt, ſand, ſtones, pieces of wood, from the neighbouring Foreſts; and therefore there was an abſolute neceſſity to leave ſome ſpace for all this ſtuff, to prevent obſtructing or ſpoiling the Pipes. On which occaſion it is to be added, that foraſmuch as in length of time this dirt may be heaped up to ſuch a height, as to ſtop up the Pipes; to avoid this inconvenience, there hath been made in the ſaid ſquare Cavity an Opening below, anſwering to the Aqueduct; which Opening is to be commonly ſhut by a great Iron-gate, that can be drawn up, or opened at pleaſure from the Gallery; that ſo the water finding this vent, and forcibly iſſuing, may carry with it all the dirt, or other ſtuf that ſhall be gathered at the bottom of this Store-houſe.

This Work is ſo well contrived and executed, that 'tis thought there never was ſeen in the world a Body of Maſonry more ſolid than this; the charges of which are yet not conſiderable in proportion, becauſe the Stones, Lime, Sand and Water are to be had upon the place.

As to the Grand *Baſon*, to which the Waters of the Store-houſe are by the Channel of St. *Feriol* to be conveyed; the figure and compaſs of it having been already deſcribed in the *Tranſactions* above-mention'd; we find only theſe particulars to be added thereto, *viz. That* it is to be two fathoms deep all over; *that* it receives the waters of the ſaid Channel at one of its Corners, and diſtributes them by two others, through two Channels, into the Ocean and Mediterranean; *that* there are moreover to be two other Channels; one to diſcharge the Baſon when there is too much water; the other is not to come out of the Baſon, but the Deriving Channel, to make the dirty waters, that it may bring down, to run out, that ſo the Pond receiving no other but clear and clean waters, may not be filled up with mud.

This Baſon is in a manner quite done. For its ornament, it is to have not only an elegant key, but a regular Town built round about it after the model of the *Place Royal* of *Paris*; all the houſes alike and equal, with great Arches beneath, to go under cover to the Key. There is alſo to be an Arſenal, for Boats to lye under, and for containing all neceſſaries to build and furniſh them.

If any one ſhall ask, how far this Work is advanced, this Author aſſureth, that there is ſo much of it done, that before the end of this year it will be Navigable from the Baſon to the *Garonne*. And if it ſhould be doubted, whether the above-deſcribed Store-houſe will be ſufficient to furniſh water at all times; the ſame tells you, that the places are ſo diſpoſed, that below that great Magazin one may make two or three more, and with little coſt convey in Winter the ſuperfluous waters of the ſame Rivers, that come out of the Black Mountain, into them, for a further ſupply.

This Royal Channel is every where five fathoms large at the bottom, and for the moſt part nine fathoms and two feet broad above. It is ordinarily between ſix and nine foot deep, and ſometimes more. And in regard that there is a conſiderable fall for about ten Languedoc-leagues, from the Point of Diſtribution (where 'tis higheſt) unto its diſcharge into the *Garonne*, where it is very low, you deſcend and aſcend by the means of eighteen Sluſes, which at certain diſtances do cut this Channel, and bear up the waters that are above.

But, as to the Communication of this Channel on the other ſide of the Great Baſon towards the *Mediterranean*; that will require time: Yet the Work is there begun, and the ſame order and rules will be obſerv'd on that ſide, as on the other, as well for the opening of the Channels, as the ſtructure of the Gates and Sluces. And here is not to be omitted, what is moſt important for this Communication, which is, That they have undertaken to make a Sea-port at Cape *Cette*, as the moſt convenient place on that Coaſt for ſuch a purpoſe; and that there are already a thouſand men working at it. *Cette* is a Promontory near *Frontignan*; on one ſide it hath the Sea, and on the other, the Lakes of *Thau*, *Magelonne*, and *Peraut*, bounded by the Plains of the lower Languedoc. The Sea there hath been found deep enough for Ships of five and ſix hundred Tuns; and round about the Cape there is 20, 21, 23, 24 feet of water. And here it is, where a *Mole* is not only begun to be made, but conſiderably advanced; inſomuch that many Veſſels lye there already with ſafety, there being not a day, but ſome Ship or other comes in for ſhelter; and others alſo come there to lade from *Genoa*, *Narbonne*, &c. And not long ſince it happen'd, that in a very violent Tempeſt on that Sea, there came in ſeventy Ships, and ſaved themſelves here; and at another time, upon the like occaſion, forty five Sail retired thither, and ſo eſcaped Ship-wrack: beſides that the Ankrage is very good on that Coaſt. All which giveth encouragement to build there a good Town; there being already made a number of ſmall houſes for Workmen to live in.

This Cape *Cette* is by a Cut of eight hundred fathoms joyn'd with the Deep Lake of *Thau*; which Cut is almoſt finiſh'd. And when altogether perfected, it will prove a conſiderable Harbour and place of Safety for thoſe that navigate in this part of the Mediterranean, call'd the *Golf of Lyons*, which extends it ſelf from the Coaſt of *Provence* all along that of *Languedoc* and

Rouſillon unto Spain, and is ſo famous for Storms and Wracks; Navigation being there the more dangerous, becauſe the Southern Winds reigning in this Sea, and alwaies by their force driving the Ships to the ſhore, theſe are in continual danger of ſplitting upon the Sands, for want of an Haven to retreat unto. So that by the Eſtabliſhment of this Port, Navigation will in thoſe parts be rendred much more ſafe, and a gate to Commerce opened to *Languedoc.*

But to ſpeak in general of the main advantages,aim'd at by this Communication of the two Seas,there are three; *Firſt*, that by this means *Languedoc* will be in a capacity of vending their Commodities of Oyles,Wines,Grains,Wool, in which that large Province abounds. *Secondly*, that whereas hitherto they have been obliged to carry all the Merchandiſes of the *Levant*, with great charge and danger, all along the coaſt of *Spain* round about, through the Straights of *Gibraltar*; the ſame may henceforth be brought to *Bourdeaux*, and other Ports of France lying upon the Ocean, by a much ſhorter, ſurer, and even, as 'tis thought, a cheaper way: However, the Boats that will be able to go in this Channel, can have no more than 8, 9 or 10 fathoms in length, and 2½ or 3 fath. in breadth. *Thirdly*, that henceforth a man may travel round about *France* by Water, ſave four days journey by Land. For by taking Boat at *Guyſe* on the River of *Oyſe*, lately made Navigable above *Fere*, one may deſcend unto its mouth, where it enters into the *Seine*; and then, paſſing St.*Germain*, St.*Denis*, *Paris*,*Corbeil*, *Melun*, go up as far as *Montreau*, and there take the River *Yonne*, and go as far as *Auxerre*; where you quit the River, and go by land to *Chalons*,ſeated on the *Soane*; deſcending thence to *Lyons*, and ſo falling down to *Taraſcon*: And having left the *Rhone*, take the *Robine* of *Aigues-mortes*, which is an ancient Channel, communicating from that River with the Lakes of *Languedoc*; and ſo afterwards go up through the Channels of *Narbonne*, *Carcaſſone*, and *Caſtlenaudary* to *Tolouſe*; thence paſs on the *Garonne* to *Bourdeaux*, and there embarque, and coaſt it about that part of *France* which lyes upon the Ocean, and ſo re-enter the *Seine*, and ſee *Roan* and the other Towns lying on that River, until you come again to the mouth of the *Oyſe*, whence you firſt parted.

So far the *firſt* Letter of M. *Froidour*; who in a Second to the ſame M. *Barillon* declareth, that they are convinced of the ſafety and uſefulneſs of the Port of *Cette*, and that a great Trade is actually begun there: As alſo, that a ſtately Barge, expreſly made for the ſolennity, had, together with three of the greateſt Veſſels of the *Garonne*, paſſed with good ſucceſs to *Naurouze*, the place whereabout the great Baſon is. To which he adds, that if they continue to work at this Channel with the ſame care and fervour they now do, in two years time the whole Communication will aſſuredly be compleated.

In a *third* Letter the ſame perſon takes notice, that about ſix weeks before the time of the writing thereof, of three Ships of St. *Malo*, that were in a great Storm in the *Golf* of *Lyons*, two having been broken upon the Sands, for want of knowing the Port of *Cette*, the third, holding out ſomewhat longer, and ſeen from that Cape, and thence ſuccour'd by ſome Chaloups, which advertis'd him that he was near the ſaid Port, arriv'd there and was ſaved. He concludes this Letter, by aſſuring his Friend, that if the Channel were as well finiſh'd on the ſide towards the Mediterranean, as 'tis on that towards the Ocean, the Country of *Provence* might have drawn this year more than a Million by the ſale of its Corn in *Malta, Sicily*, and many parts of *Italy*: And alſo, that the Undertakers did then reſolve to wait upon the King, to give his Majeſty an aſſurance of the ſucceſs of this Work; and that none but ignorant and perverſe Spirits can any more doubt of it.

A Latin Letter written to the Publiſher *April* 9. 1672. n. ſt. by *Ignatius Gaſton Pardies* P. Prof. of the Mathematicks in the Pariſian Colledge of *Clermont*; containing ſome Animadverſions upon Mr. *Iſaac Newton*, Prof. of the Mathematicks in the Univerſity of *Cambridge*, his *Theory of Light*, printed in N°. 80.

L*Egi ingenioſiſſimam Hypotheſin de* Lumine & Coloribus *Clariſſimi* Newtoni. *Et quia nonnullam Ego operam dedi in iſta contemplatione atque Experimentis peragendis, perſcribam ad Te pauca, quæ mihi circa novam iſtam doctrinam occurrerunt.*

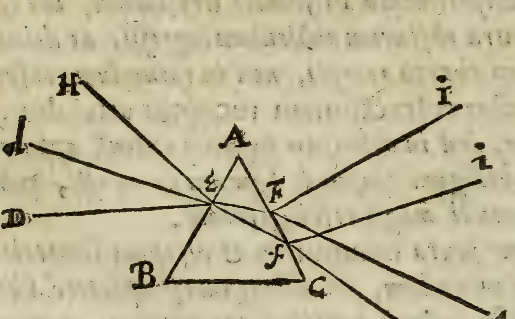
Circa ipſam Luminis naturam illud profectò extraordinarium videtur, quòd ait vir eruditiſſimus, Lumen conſtare ex aggregatione infinitorum propemodum radiorum, qui ſuâpte indole ſuum quiſque colorem referant retineantque, atque adeò nati apti ſint certâ quadam & peculiari ratione, plus alij, alij minus, refringi: Radios ejuſmodi, dum promiſcui in aperto lumine confunduntur, nullatenus diſcerni, ſed candorem potiùs referre; in refractione verò ſingulos unius coloris ab aliis alterius coloris ſecerni, & hoc modo ſecretos, ſub proprio & nativo colore apparere: Ea corpora ſub aliquo colore, v. g. rubro, videri, quæ apta ſint reflectere aut tranſmittere radios ſolummodò rubros, &c.

Iſtæc tam extraordinaria Hypotheſis, quæ, ut ipſe obſervat, Dioptricæ fundamenta evertit, praxêſque hactenus inſtitutas inutiles reddit, tota nititur illo Experimento Priſmatis Cryſtallini, ubi radij per foramen feneſtræ intra obſcurum cubiculum ingreſſi, ac deinde in parietem impacti, aut in charta recepti, non in rotundum conformati, ut ipſi, ad regulas refractionum receptas attendenti, expectandum videbatur, *ſed in oblongam figuram extenſi apparuerunt: Unde concluſit, oblongam ejuſmodi figuram ex eo eſſe, quòd nonnulli radij minus, nonnulli magis refringerentur.*

Sed mihi quidem videtur juxta communes *& receptas Dioptricæ* leges *figuram illam, non rotundam, ſed oblongam eſſe oportere. Cùm enim radij ex oppoſitis diſci Solaris partibus procedentes, variam habeant in ipſo tranſitu Priſmatis inclinationem, variè quoque refringi debent; ut cùm unorum inclinatio 30 ſaltem minutis major ſit inclinatione aliorum, major quoque evadat illorum Refractio.*

Igitur Radii oppoſiti, ex altera ſuperficie Priſmatis emergentes magis divergunt & divaricantur, quàm ſi nullatenus, aut ſaltem æqualiter, omnes infracti proceſſiſſent. Refractio autem iſta radiorum fit ſolummodo versùs eas partes quæ fingi poſſunt in planis ad axem Priſmatis rectis; nulla autem refractionis inæqualitas contingit versùs eas partes, quæ intelliguntur in planis axi parallelis; ut facilè demonſtrari poteſt: ſuperficies enim duæ Priſmatis cenſeri poſſunt inter ſe parallelæ, ratione habita ad inclinationem axis, cùm ſingulæ ipſi axi parallelæ ſint. Refractio autem per duas parallelas planas ſuperficies nulla computatur, quia quantùm à prima ſuperficie radius in unam partem torquetur, tantum ab altera in oppoſitam partem detorquetur. Igitur cùm radij ſolares è foramine per Priſma tranſmiſſi ad latera quidem non frangantur, procedunt ulterius, perinde ac ſi nulla Priſmatis ſuperficies obſtitiſſet, (habitâ, inquam, ratione ſolùm ad lateralem illam divaricationem;) at verò cùm iidem radij ad ſuperiores ſeu inferiores partes, alij quidem magis, alij verò minus, utpote inæqualiter inclinati, infringantur; neceſſe eſt eos magis inter ſe divaricari, adeóque & in longiorem figuram extendi.

Quin ſi calculus ritè obeatur; ut radij lateralès inventi ſunt à Cl. Newtono *in ea latitudine quæ ſubtendit arcum* 31'*, qui arcus reſpondet diametro Solis; ita nullus dubito, quin illa inventa quoque altitudo imaginis, quæ* 2 *gradus &* 49' *ſubtendit, ſit illa ipſa quæ eidem diametro Solis poſt inæquales refractiones in illo ipſo caſu reſpondeat.*



Et reverâ, poſito Priſmate ABC, *cujus angulus* A *ſit* 60 *grad. Radio* DE, *qui faciat cum perpendiculari* EH *angulum* 30 *grad. Invenio illum, dum emergit per* FG, *facere cum perpendiculari* FI *angulum* 76 *gr.* 22'. *At verò poſito alio radio* d E, *qui cum perpendiculari*

culari EH *faciat angulum* 29°. 30', *invenio illum, dum emergit per* fg, *facere cum perpendiculari* fi, *angulum* 78°. 45'. *Unde iſti duo radij* DE, dE, *qui procedere ſupponuntur ex oppoſitis partibus diſci Solaris, faciuntque inter ſe angulum* 30', *iidem dum emergunt per lineas* Fg, fg, *ita divergunt ut conſtituant angulum inter ſe* 2 *gr*. 23'. *Quod ſi duo alij radij aſſumerentur magis accedentes ad perpendicularem* EH, (*v.g. qui cum eadem perpendiculari facerent, unus quidem, angulum* 29°. 30', *alter verò*, 29°. 0';) *tunc iidem radij emergentes magis adhuc divergerent, conſtituerentque angulum majorem etiam aliquando plus quàm trium graduum. Et præterea augetur ulterius iſta intercapedo refractorum radiorum ex eo, quòd duo radij* DE, dE, *concurrentes in* E, *illico incipiunt divaricari, atque impingunt in duo puncta disjuncta alterius ſuperficiei, nempe in* F *& in* f. *Quapropter non ſufficit ad obeundum ritè calculum, ex longitudine imaginis impactæ in chartam ſubtrahere magnitudinem foraminis feneſtræ; quandoquidem etiam poſito foramine indiviſibili* E, *adhuc fieret aliud veluti foramen latum in alia ſuperficie, nempe* Ff.

Quod etiam vocat Experimentum crucis, *mihi quidem videtur quadrare cum vulgaribus & receptis Refractionum regulis. Nam, ut modo oſtendi, radij ſolares, qui accedentes & convergentes faciunt angulum* 30', *egredientes deinde etiam poſt indiviſibile foramen divergunt in angulum duorum & trium grad. Quapropter non mirum, ſi iſti radij, ſigillatim impingentes in alterum Priſma, perexiguo item apertum foramine, inæqualiter infringantur, cùm ſit inæqualis illorum inclinatio. Neque refert, quòd iſti radij attollantur aut deprimantur per converſionem primi Priſmatis, manente immoto ſecundo Priſmate, (quod tamen in omni caſu fieri non poteſt) vel quòd manente primo immobili, ſecundum moveatur, ut ſucceſſivè radios coloratos totius imaginis excipiat & per proprium foramen tranſmittat; utrolibet enim modo neceſſe eſt radios illos extremos, hoc eſt,* Rubrum *&* Violaceum, *incidere in ſecundum Priſma ſub inæquali angulo, adeoque eorundem refractionem eſſe inæqualem, ut* Violaceorum *ſit major.*

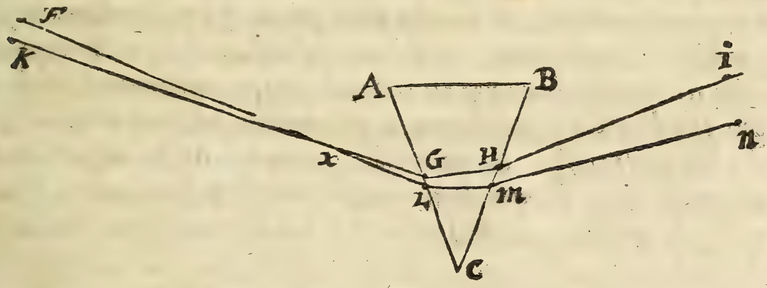
Cùm igitur manifeſta cauſa appareat oblongæ ejuſmodi figuræ radiorum, cauſaque illa ex ipſa natura Refractionis oriatur; non videtur neceſſe recurrere ad aliam Hypotheſin, aut admittere diverſam illam radiorum frangibilitatem.

Quod deinde excogitavit de Coloribus, *illud quidem egregiè conſequitur ex precedente Hypotheſi ; veruntamen nonnullas & ipſum patitur difficultates. Nam quod ait, nullum colorem, ſed potius* candorem *apparere, ubi omnes omnium colorum radij promiſcuè confunduntur, id verò non videtur conforme omnibus phænomenis. Certè quæ variationes cernuntur in permiſtione diverſorum corporum, diverſis coloribus imbutorum, eædem omninò obſervantur in permiſtione diverſorum radiorum diverſis item coloribus imbutorum: Atque optimè ipſe advertit, quòd quemadmodum ex flavo & cæruleo corpore exſurgit viridis color; ita ex flavo & cæruleo radio viridis item color efficitur. Quare ſi omnes omnium colorum radii ſimul confunderentur, neceſſe eſſet in iſta hypotheſi, ut ille color appareret, qui revera apparet in permixtione omnium pigmentorum. Atqui ſi iſta, hoc eſt, rubrum ſimul & flavum unà cum cæruleo & purpureo aliiſque omnibus, ſi quæ ſint, conterantur & confundantur, non jam candidus, ſed obſcurus & ſatur color exſurget. Ergo ſimilis color appareret in lumine ordinario, quod conſtaret ex aggregatione omnium colorum.*

Præterea nihil primo aſpectu magis ingenioſum magiſque aptum videtur, quàm quod ait circa experimentum acutiſſimi Hookii, *quo duo diverſi liquores, quorum alter rubeus, alter cæruleus, uterque ſigillatim pellucidus, ſimul permixti, opaci evadunt. Id autem ait Clariſſimus* Newtonus *ex eo oriri, quòd unus liquor ſolos rubeos natus ſit tranſmittere, alter verò ſolos flavos; unde permiſti nullos tranſmittent. Hoc, inquam, videtur ſtatim valdè appoſitum; nihilominus tamen ex eo conficeretur, quòd ſimilis opacitas fieret in permiſtione quorumcunque liquorum qui eſſent diverſi coloris; quod tamen verum non eſt.*

Mr. *Newtons* Letter of *April* 13. 1672. ſt. v. written to the Publiſher, being an Anſwer to the fore-going Letter of *P. Pardies.*

ACcepi Obſervationes Reverendi Patris Ignatii Pardies *in Epiſtolam meam de Lucis Refractionibus & Coloribus ad Te conſcriptam: quo nomine me illi valde devinctum agnoſco; atque hoc difficultatibus, quas propoſuit, eluendis reſcribo. Imprimis ait, longitudinem ſolaris Imaginis à refractione Priſmatis effectam non aliâ indigere causâ, quàm diversâ radiorum ab oppoſitis partibus ſolaris diſci profluentium incidentiâ, adeoque non probare diverſam refrangibilitatem diverſorum radiorum. Et, quò aſſertionis ejus veritatem confirmet, oſtendit caſum, in quo ex* diverſa *incidentia 30 minutorum, differentia refractionis poteſt eſſe 2 grad. 23. min. vel etiam paulo major, prout exigit meum experimentum. Sed hallucinatus eſt R. P. Nam refractiones à diverſa parte Priſmatis quantum poteſt inæquales ſtatuit, cùm tamen ego tum in experimentis, tum in calculo de experimentis iſtis inito, æquales adhibuerim, ut in Epiſtola præfata videre eſt. Sit ergo A B C Priſmatis ſectio ad axem ejus perpendicularis, F L & K G radii duo in x (medio foraminis) decuſſantes & in Priſma illud incidentes ad G & L; ſintque eorum refracti G H & L m, ac denuò H I & m n. Et cùm refractiones ad latus A C æquales eſſe refractionibus ad latus B C quam proximè ſuppoſuerim; Si A C & B C ſtatuantur æqualia, ſimilis erit radiorum G H & L m ad AB baſin Priſmatis inclinatio; adeoque ang. C L m = ang. C H G & ang. C m L = ang. C G H. Quare etiam refractiones in G & m æquales erunt, ut & in L & H;*



atque adeò ang. KGA = ang. nmB, & ang. FLA = ang. BHI; & proinde refractorum HI & mn eadem erit ad invicem inclinatio ac eſt incidentium radiorum FL & KG. Sit ergo angulus FxK 30 min. æqualis nempe ſolari diametro, & erit angulus, quem HI & mn comprehendunt, etiam 30 min. ſi modò radii FL & KG æqualiter refrangibiles ſtatuantur. At mihi experienti prodiit angulus ille circiter 2 grad. 49. min. quem radius HI, extremum violaceum colorem, & mn, cæruleum exhibens, conſtituêre; ac proinde radios illos diverſimodè refrangibiles eſſe, ſive refractiones ſecundùm diſparem ſinuum incidentiæ & refractionis rationem peragi neceſſariò concedendum eſt.

Addit præterea R.P. quòd non ſufficit ad obeundum ritè calculum, ex longitudine imaginis impactæ in Chartam ſubtrahere magnitudinem foraminis feneſtræ; quandoquidem etiam poſito foramine indiviſibili, adhuc fieret aliud veluti foramen latum in poſteriori ſuperficie priſmatis. Mihi tamen videtur, his non obſtantibus, quòd refractiones radiorum, in anteriori æquè ac in poſteriori ſuperficie Priſmatis decuſſantium, ex adhibitis principiis poſſint ritè computari. Sed ſi res ſecùs eſſet, latitudo hiatûs in poſteriori ſuperficie, quod ad inſtar foraminis eſt, haud efficeret errorem duorum minutorum ſecundorum; & in rebus practicis non operæ pretium duco ad minutias iſtas attendere.

Illi inſuper experimento, quod Crucis vocaveram, nihil adverſatur R.P, dum contendit, inæquales radiorum, diverſis coloribus imbutorum, refractiones ex inæqualibus incidentiis effectas fuiſſe. Nam radiis per duo admodum parva, ab invicem diſtantia & immota foramina, tranſeuntibus, incidentiæ illæ, prout ego experimentum inſtitui, omninò æquales erant, & tamen refractiones liquidò inæquales. Sin ille de experimentis noſtris dubitet, oro, ut radiorum diverſis coloribus præditorum refractiones ex incidentiis paribus menſuret, & ſentiet inæquales eſſe. Si modus ille, quem ego ad hoc negotium adhibui, minùs placeat (quo tamen nullus poteſt eſſe luculentior,) facile eſt alios excogitare; ſicut & alios ipſe haud paucos cum fructu expertus ſum.

Contra Theoriam de Coloribus objicitur, quòd pulveres diverſorum colorum permiſti non candidum ſed ſubobſcurum & fuſcum colorem exhibent. Mihi verò albus, niger, & omnes intermedii fuſci, qui ab albo & nigro permiſtis componi poſſunt, non ſpecie coloris ſed quantitate lucis tantùm differre videntur. Et cùm in miſtione pigmentorum, ſingula corpuſcula non niſi proprium colorem reflectant, adeoq; maxima pars lucis incidentis ſupprimatur & retineatur; lux reflexa ſubobſcura evadet, & quaſi cum tenebris permiſta, adeò ut non intenſum alborem, ſed qualem nigredinis permiſtio conficit, hoc eſt. fuſcum, exhibere debeat.

Objicitur deinde, quòd à liquoribus quibuſcunque diverſi coloris in eodem vaſe commiſtis, æquè ac in diverſis vaſis contentis, opacitas oriri debet; quod tamen, ait, verum non eſſe. Sed non video conſequentiam. Nam plurimi liquores agunt in ſe invicem, & novam ſibi mutuò partium contexturam ſecretò inducunt; unde opaci, diaphani, vel variis coloribus, ex coloribus permiſtorum nullo modo oriundis, præditi evadere poſſunt. Et hâc de causâ experimenta hujuſmodi minùs apta ſemper exiſtimavi, à quibus concluſiones deduci poſſint. Subnoto tamen, quòd ad hoc experimentum requiruntur liquores ſaturis & intenſis coloribus præditi, qui perpaucos niſi proprii coloris radios tranſmittant; quales rarò occurrunt, ut videbitur illuminando liquores cum diverſis coloribus Priſmaticis in obſcurato cubiculo. Nam pauci reperientur, qui in propriis coloribus ſatis diaphani appareant, inque alienis opaci. Convenit præterea, ut adhibiti colores ſint inter ſe oppoſiti, quales exiſtimo fore rubrum & cæruleum, vel flavum & violaceum, vel etiam viridem & purpureum illum qui coccineo affinis eſt. Et ex hujuſmodi liquoribus nonnulli (quorum partes tingentes non congredientur) fortaſſe permiſti evadent opaciores. Sed de eventu nihil ſum ſollicitus, tum quod luculentius eſt experimentum in liquoribus ſeorſim exiſtentibus, tum quod experimentum illud (ſicut & Iridis, Tincturæ Nephriticæ, & aliorum corporum naturalium phænomena) non ad probandam ſed ad illuſtrandam tantùm doctrinam propoſui.

Quod R. P. Theoriam noſtram Hypotheſin vocat, amicè habeo, ſiquidem ipſi nondum conſtet. Sed alio tamen conſilio propoſueram, & nihil aliud continere videtur quàm proprietates quaſdem Lucis, quas jam inventas probare haud difficile exiſtimo, & quas ſi non veras eſſe cognoſcerem, pro futili & inani ſpeculatione mallem repudiare, quàm pro mea Hypotheſi agnoſcere. Quid verò cenſeri mereatur, ex reſponſionibus ad animadverſiones Domini N.N. fortaſſe ſtatim prodituris clariùs patebit. Interea vale, & perge amare

Tibi devinctiſſimum

J. Newton

Tro

Two Obſervations about Stones found, the one in the Bladder of a Dogg, the other faſtned to the Back-bone of a Horſe: both mentioned in two Roman Journals de Letterati.

I. THE Dogg was a pretty Spaniel, two palms and a half high, white, and an excellent ſetter for Quails. Being kept tyed, as ſuch doggs are wont to be, he would rather have burſt than urine or dung in the place where he was kept. By reaſon of his aptneſs to bite, he was cut when he was five years old, and two years after that, he began to urine with much difficulty. Whereupon as often as he was let looſe, he ran preſently into the Garden and fell to eat of *Pellitory of the Wall*, and *Fig-leaves.* This diſeaſe continued upon him for five years together, ſometimes with that violence that his Maſter had him ſiringed, and anointed with oyl of Scorpions, and uſed other remedies to help the poor creature.

At length he died at twelve years of age, and being opened by a skilful Anatomiſt, there was found in his bladder a ſtone weighing an ounce, of an irregular figure, white, yet here and there with ſome reddiſh ſpecks; and in the bottom of the bladder was found ſtore of ſmall white gravel, and in the mouth of the urinal paſſage a ſtone as big as a great pine-kernel, white and tender. The reſt of the body was all ſwelled.

It may be noted here (*ſaith the Italian Journaliſt*) that *Matthiolus* and others ſay, that the Juice of *Pellitory* doth much provoke urine; and that it doth ſo eſpecially, when being heated upon a tile and ſprinkled with a little Malmeſy, it is applied to the part. And as to *Fig-leaves*, he adds, that Phyſicians adſcribe to Figs an abſterſive vertue, opening the body and cleanſing the reins: Of which vertue the Leaves may perhaps participate. Thus Brutes ſeem to know, without any direction from a *Dioſcorides*, or *Matthiolus*, or other Botaniſt, the herbs proper for their diſeaſes.

II. The other Stone, that was faſten'd to the *back-bone* of a Spaniſh Gelding, that died at the age of between thirteen and fourteen years, weighed four ounces and an half; it was round and a little flatted; of an olive colour, marked with red ſpecks, like coagulated blood; and ſo poliſhed and ſhining, that it reflected Images. It was wrapped up in a membrane full of fat, and faſtned on both ends to the back bone, over againſt the Kidneys. Though this Horſe had been dead twelve hours before it was opened; yet was it ſtill very warm, and kept that warmth above ſix hours after it was opened. This ſtone is kept among the Rarities of Signor *Bartolini*, an Italian Riding-maſter.

An Accompt of ſome Books.

I. *An* ESSAY *about the Origine and Vertues of* GEMS; *by the Honourable* Robert Boyl *Eſquire, Fellow of the* R. Society. *Printed at* London, 1672. *in* 8°.

THE deſign of the Noble Author of this excellent Treatiſe being, to propoſe and hiſtorically to illuſtrate therein ſome conjectures of his about the Conſiſtence of the Matter of Precious Stones, and the Subjects wherein their chief vertues reſide; he compriſes the ſubſtance of all in theſe *two* particulars: *Firſt*, That many of theſe Gems, and the Medical Stones, either were once *fluid* Bodies, as the Tranſparent ones, or in part made up of ſuch ſubſtances as were once fluid. *Secondly*, That many of the *real* virtues of ſuch Stones may be probably derived from the *mixture* of *Metalline* and other mineral ſubſtances, which are uſually (though unſuſpectedly) incorporated with them; and that the *greatneſs* of the Variety and Efficacy of thoſe virtues may be attributed to ſome happy concurrent circumſtances of that commixture.

The *firſt* of theſe Heads relateth properly to the *Origine* of *Gems*: the *ſecond*, partly to that, and partly to the *kinds* and *degrees* of their *virtues*.

To countenance the former, the Author alledges for his *firſt* Argument ſeveral Conſiderations, taken firſt from the Diaphaneity of Gems; ſecondly, their external figuration; thirdly, their internal texture; fourthly, their Colours that ſeem to be adventitious and imparted by ſome coloured Mineral Juice, or ſome tinging Mineral exhalation, whilſt the Stone was either in *ſolutis principiis*, or of a texture penetrable by mineral fumes; fifthly, from the Heterogeneous matter included in Solid Gems, both tranſparent, and opacous, though very rarely in the former kind; ſixthly, from the proofs, to be met with *below* in the ſecond member of the Authors Hypotheſis; wherein it appears, that ſeveral even of the Tranſparent Gems have metalline or other extraneous mineral bodies mingled with them *per minima*; which mixture is reaſonably ſuppoſed to have been made, when the mingled bodies were in a fluid form.

Theſe conſiderations being diſpatch't, they are follow'd with a very Inſtructive Anſwer to a main Objection, raiſed from the exquiſite uniformity of ſhape, ſo admired in Gems, (eſpecially the Priſmatical one in Cryſtal,) and thought to demonſtrate their being formed by a Seminal and Geometrizing Principle.

This done, the Author proceeds to the *ſecond* of thoſe Grand Arguments, whereon his Hypotheſis was grounded. And this is built upon the *weight* of ſome Gems, which being greater than that which ſeems to belong to them as hard and tranſparent Stones, he thinks he may probably derive it from Metallin or Mineral mixtures. Where he ſhews, how he came to know the truth of what he here delivers, and what ſtandard he pitch't upon whereby to make a probable eſtimate of the weight of Gems; which was by finding out the Ponderouſneſs of Cryſtal in reference to Water.

To this he ſubjoyns a *third* Argument, taken from hence, that out of divers Medicinal Stones, and even out of ſome fine Gems, real and corporeal Metals or other Mineral ſubſtances may be extracted: which Argument he proſecutes largely in the *Second Section*; where he delivers

A Conjecture about the *Cauſes* of the *Virtues* of Gems; which is, That the Author conceives, that ſome (at leaſt) of the *real* Virtues (the many *fabulous* ones being by him juſtly exploded) of divers Gems may be derived from this; That whilſt they were in a fluid form (or at leaſt not yet hardned,) the Petreſcent ſubſtance was mingled with ſome Mineral ſolution or tincture, or with ſome other impregnated liquor, and that theſe were afterwards con-coagulated, or united and hardned into one Gem. And as divers of the Virtues of Gems may be in

a

a general way deduced from the Commixture of theſe Mineral Corpuſcles ; ſo the greatneſs of thoſe virtues and the variety of thoſe proprieties in particular may be aſcribed to the peculiar nature of the impregnating liquors, to the diverſity of them, and to the greater and leſſer proportions, wherein they are mixt with the petreſcent Juice.

Having made this Conjecture probable as to *Tranſparent* Gems, and withal occurr'd to ſome ſpecious Objections; he deſcends to make it out, that thoſe Arguments, which he hath produced to prove, that Diaphanous Gems may be endow'd with Virtues by the Mineral ſubſtances they contain or are in part made up of, will hold more ſtrongly as to *Opacous* ones : which he further confirms by four particular Arguments ; fetched *partly* from the great ſpecifick Gravity of divers Opacous and Medicinal ſtones ; *party* from the fitneſs of his Hypotheſis to render a reaſon of divers *phænomena* relating thereunto, ſome of them ſcarce at all, and others much leſs probably to be accounted for without it ; *partly* from the Metallin ſubſtances to be manifeſtly ſeparated or obtained from the Stones he is treating of ; and *partly* from the Nature of the Bodies whereof Medicinal Stones ſeem to be compounded : In which laſt it is peculiarly obſerved by the Author, that the ſubtlety and penetrancy of ſome Liquors, if duly conſidered, may evince it to be poſſible, that ſuch Bodies ſhould be petrified by them and with them, as may in part conſiſt of Animal and Vegetable ſubſtances; as in petrified Skulls, Bones, and pieces of Wood. Beſides, that not only there may be *Bolus's*, Sealed Earths, and ſuch like foſſils that are commonly known to be Medicinal, hardned into Stone by petrifying Agents ; but that alſo other Earths, ſubject to be petrified, may have Medicinal and ſubtle particles of ſuch a kind in them, as ſcarce any body would expect : of which he alledges ſome notable Inſtances. But for them, and many other uncommon obſervables we muſt refer the Curious Reader to the Book it ſelf.

II. Johannis Swammerdami *M. D. UTERI MULIEBRIS Fabrica; unà cum Methodo nova Cavitates corporis ita præparandi, ut ſuam ſemper genuinam faciem ſervent.* Lugduni Batav. 1672. *in* 4°.

THE Publiſher of theſe Tracts thinks himſelf obliged in a particular manner to do right to the Learned Author of this Book, as well upon the account of the matter contained therein, as his obliging way of dedicating it by a Letter of *June* 14. 1672. to the *Royal Society*; in the doing whereof he ſhews himſelf ſo generous and candid, as notwithſtanding the preſent Rupture between the two Nations, *England*, and the *United Provinces* (of which latter he is a Subject) he ſcruples not ſolemnly to acknowledge, *Neſcire ſe* (to give you his own words) *quo factum ſit fato, ut, quemadmodum Chriſtianus Orbis non minima Religionis ſuæ incrementa Anglicæ genti debet; ita ultimis difficillimiſque his temporibus apud Eam inventa ſit ratio, quâ, miſſis inanibus Scholaſticorum diſputationibus, bonæ artes & ſcientiæ in ſolido locentur: Quod ipſum ut non poſtremam gloriæ Britannicæ partem abſolvit, ita in cauſa eſſe* ait, *ut in Naturalis Philoſophiæ negotio ad nullum aliud quàm* Regiæ Societatis *Tribunal provocare vel auſit vel debeat.*

But to paſs to the particulars of the matter it ſelf, they are chiefly two: *Firſt*, he comments upon the *Prodromus* of that famous Anatomiſt *D. Joh. Van. Horne*, printed 1668; treating *de partibus Generationis in utroque ſexu*: Unto which he adds ſuch things as himſelf had obſerved on that ſubject; not allowing to the ſaid *Van Horne*, that the *Spermatick Artery* hath no cavity; denying the *Spermatick Vein* to agree any waies with the Scheme of *De Graaf*; affirming the proceſſes of the *peritonæum* in men and women not to go beyond the *inguina*; obſerving that *De Graaf* is not well acquainted with the *ductus* of the veins and arteries in *teſticulis*; doubting yet, where, and how the *vaſa teſticularia* do unite with the *præparantia*; denying, that the ſame *vaſa teſticularia* have a connexion with the *ductus Highmorianus*, and affirming them to be continued with the *Epididymis*; denying likewiſe, that the *vaſa deferentia* have a communication with the *veſiculæ ſeminales*, againſt Dr. *De Graaf*; maintaining, that there is (not a threefold *Seed*, but) a threefold *matter of Seed*, if not a fourfold; taking notice of the admirable ſtructure of the ſpermatick Artery in *Tauris*; mentioning divers curious particulars in *pene*; as alſo in the ſtructure of the *veſiculæ ſeminales*, eſpecially in *Moles*; offering to verifie his Schemes of the *Uterus muliebris*, here delineated, by the part it ſelf; and excepting againſt thoſe of *De Graaf*; animadverting in ſome figures of that accurat Anatomiſt, *Malpighi*, eſpecially as to the Spermatick parts of the Male, and the Spinal Marrow; affirming poſitively, *teſticulos mulierum inſtar ovarij eſſe, & ſtructurâ ſuâ cum reliquis animantium ovariis convenire*; and withal examining the manner of the motion and paſſage of Eggs out of the *Ovarium* into the *Uterus*; which he finds as obſcure in creatures that are by all acknowledged to be Oviparous, as in the other femals; foraſmuch as he cannot find any more connexion between the *Ovarium* and *Infundibulum* in Poultry, &c. than in Women: And if it have been obſerved, that in Hens the ſaid *Infundibulum* hath with its membranous expanſions embraced the *Ovarium*; he believes, that the ſame comes to paſs in Women *tempore conceptionis*, and that then the *tuba Fallopiana*, being applied to the teſticles, receives by its orifice the very Egg, that is to breed the fœtus. Where he taketh ſpecial notice of *Frogs*, that at once lay many hundreds of Eggs, which do ſingly follow one another through the *ovi-ductus*; in which Creatures he meets with the ſame difficulty, ſince the orifice of the *tubæ* is not only near two inches diſtant from the *ovarium*, but alſo very ſtraight, and withall ſeeming immovable, and un-applicable to that *ovarium*. He examins alſo that Obſervation of *Kerkringius* about a *fœtus* of three daies old.

Moreover he promiſes, that he intends in his curious Anatomical Treatiſe, which he deſigns to publiſh, to reſtore to the Liver its office of Sanguification; wherein he promiſeth to himſelf the greater applauſe, becauſe none (as he ſaith) hath hitherto been able to ſhew, that the Chyle is conveyed ſo far as to the lacteous veſſels *primi generis*, as he calls them: which makes him to eſteem, that 'tis nothing but a whitiſh *lympha*, that appears in the lacteous veins, and iſſueth out of the glanduls of the Inteſtins, that receive their Juice from the Arteries.

After this he repreſents the *uterus humanus* in three very curious Schemes; one is of the *facies anterior*; the other of the *facies poſterior uteri puerperæ*; the third of an *uterus Virginis*.

Where he inſerts a very odd Hiſtory of the force of Imagination in breeding Women, which is this: That a woman at *Utrecht* in ſuch a condition, being ſurpriſed with the ſight of a *Negro*, and ſo exceedingly frighten'd as to become ſpeechleſs for the time, had a ſtrong fancy ſhe ſhould bring forth a black child; but, having recollected her ſelf, did by as ſtrong a fancy deviſe a remedy to defeat the former; which was with hot water to waſh away that blackneſs. And having, whilſt ſhe was thoroughly poſſeſſed with this latter fancy, waſhed her ſelf accordingly from top to toe; ſhe was at length delivered of a child that was indeed white, yet thoſe parts excepted, where the water in the waſhing had not touched; ſuch as the interſtices of the fingers and toes and ſome other places, where the manifeſt tokens of blackneſs appear'd; as this Author had been informed by the very Mother of this child.

The *ſecond* main particular in this Book is, the Deſcription of a way, ſo to prepare the Veins and Arteries and other hollow Veſſels in an Animal, that they may appear in their genuin ſhape, whereby their ſtructure, ſcite, ductus, inſertion, riſe, and the like, may clearly be ſeen. This way we ſhall give you at length in his own words; there being as yet but this one Copy, whence this account is given, in England, for ought we know.

Recipe Ceræ albæ quantum videbitur, eamque liquefactam rubro, flavo, viridi, vel quolibet alio colore convenienti tinge; & ſiphone, qui cochleâ adſtrictum tubulum habeat, properanter excipe, atque in majorem venæ vel arteriæ uteri ramum injice, cavendo ne intercedens Aer progreſſum ceræ impediat: Ac, ne quid impedimento ſit, ſanguinem, priuſquam operi te accingas, ex venis quantumpote exprime, utut rami majores aliàs faciliimè diſtendantur. Perinde autem eſt, ſive per Arteriam ſpermaticam ſive hypogaſtricam Cera injiciatur: Idemque in venis obtinet, tantùm ut valvulæ obtuſo ſtylo pertundantur; quo facto unâ injectione omnes uteri venæ, earumque partes vel ab uno latere impleri poſſunt. Idem in Arteriis fieri poteſt, ſi tamen viſibiles earundem Anaſtomoſes ſatis magnæ ſint, nec Aër progreſſum ceræ impediat.

By this method he affirms to have laid open even the ſmalleſt ramifications of the *Arteria hepatica,* that cannot be bared of the fleſh, and that are poſſibly more in number, than thoſe of the *vena porta* and *cava* put together.

III.*Three Letters of* Jo.Dominicus Caſſinus, *concerning his Hypotheſis of the Suns motion,and his doctrine of Refractions;printed at* Bononia *in* 4°.

THE *firſt* Letter is in Latine,to *Geminian Montanarius*,publick profeſſor of Mathematicks *in Bononienſi Archigymnaſio* ; who was calculating Ephemerides of the Suns place, according to the *latter* Hypotheſis of *Caſſinus.* His former *Hypotheſis* was grounded upon Obſervations of the Sun,from whoſe Altitudes,when they were great,he made no Abatement ; becauſe,according to the common opinion, the Refraction is nothing,or,at leaſt,inconſiderable.A *ſpecimen* of it, was publiſhed about 16 years ago.But afterward he changed that *Hypotheſis,* that it might agree with his obſervations as diligently made,but more artificially corrected. For, having *ex meris ſtellæ Polaris altitudinibus exactiſſimis* determined the height of the pole (and thereby of the Equinoctial,) at *Bononia* ; he obſerved alſo the Suns meridian height in both Solſtices. And ſubtracting that winter-height from that Equinoctials height ; and the ſaid Equinoctials height from the Summer height, he alwaies found that former difference leſs,by above four minutes and an half, than the latter difference. Wherefore he attempted to order the Parallaxes and Refractions ſo, as that thoſe Summer and Winter obſervations, being corrected according to that doctrine, might yield the Suns Southern greateſt declination, equal to the Suns greateſt declination Northward. In this Letter he ſets down,What courſe he took to find the Refractions; What Experiments he made in glas and in water ; How he applied them to celeſtial Refractions ; His proceeding to determine the proportion of the height of the Air to the Semidiameter of the Earth ; And at laſt to make Tables *ad ſingulos gradus apparentis diſtantiæ à vertice.* Thoſe Tables make it evident, that *Refractiones etiam in æſtivis altitudinibus ſunt ſenſibiles, & ad verticem uſque conſcendunt* ; which hitherto hath alwaies been denyed.Not only his friends in Italy approve theſe Tables,but in France alſo.*Petrus Petit in præclaro opere,quod* DE NUPERIS

COMETIS ſcripſit ediditque, ſaith, *Caſſini Tabulas* (refractionum) *& rationibus & Experimentis eſſe conformes.*

But *Ricciolus*, in a late treatiſe *Aſtronomiæ reformatæ*, hath raiſed an Expectation of his new Tables of Refraction, and queſtions thoſe Tables of *Caſſinus*: Who, in this Letter, anſwereth his objections, and ſhews, how, by obſervations *in Heliometro*, we may try whoſe Tables are beſt.

The *ſecond* Letter is in *Italian*, to *Carlo Rinaldini* Profeſſor of Mathematicks in the Univerſity of *Padua*; dated *Auguſt*.7.1666.

In it, He ſhews ſome defect in the wayes of making Experiments of Refraction, preſcribed by *Vitello, Des-Cartes, Riccioli* and *Manzini*. And then he deſcribes an Inſtrument of his own invention for that purpoſe, *&c*.

The *third* Letter is in *Italian* alſo, but without date: concerning a book of Dr. *Mengoli*; wherein is *a Table of Refractions for every degree of altitude.* But *Caſſinus* ſhews, that Table of *Mengoli* to be falſe; as being eaſily refuted by Experience, and grounded upon a wrong foundation. Moſt writers of Dioptricks ſince *Des Cartes* do agree with him, in acknowledging a conſtant *Ratio* in the *Sines* of the Angles conſidered in Refraction. But this Doctor *Mengoli*, miſtaking thoſe Angles, hath caſt away a great deal of labour in calculating ſo many Refractions, and ſo making a Table full of falſe numbers. But *Caſſinus* hopeth, that Signor *Mengoli* will review his Principles, and put true ones in their room, that ſo beginning anew he may reform the Concluſions, which he intended to demonſtrate.

IV. *Dr.* Richard Sharrock'*s Hiſtory of the Propagation and Improvement of VEGETABLES; by the Concurrence of Art and Nature. The 2d Edition much enlarged.* Oxford, 1672. *in* 8°.

THis Treatiſe ſheweth the ſeveral wayes for the Propagation of Plants uſually cultivated in *England*, as they are increaſed by Seed, Off-ſets, Suckers, Trouncheons, Cutting, Slips, Laying, Circumpoſition: The ſeveral wayes of Graftings and Inoculations; as likewiſe the Methods for improvement and beſt culture of Field, Orchard and Garden-plants; the means uſed for remedy of Annoyances incident to them; together with the Effect of Nature, and her manner of working upon the ſeveral endeavors and operations of the Artiſt. Written according to Obſervations made from Experience and Practiſe. Amongſt the many conſiderables in it, there is an Examination of Sr. *Ken. Digby*'s reports, and other ſtories of great fame.

Errata in *Numb.* 83. P.4060. l. 16. and l. 28. r. *refraction* for *reflexion*. p.4075. l. 26. and l. 33. r. *weeſel* for *ferret*.

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Numb. 85.

PHILOSOPHICAL TRANSACTIONS.

July 15. 1672.

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A Serie's of Quere's *propounded by Mr.* Iſaac Newton, *to be determin'd by Experiments, poſitively and directly concluding his new Theory of Light and Colours; and here recommended to the Induſtry of the Lovers of Experimental Philoſophy, as they were generouſly imparted to the Publiſher in a Letter of the ſaid Mr.* Newtons *of* July 8. 1672.

IN the mean while give me leave, Sir, to inſinuate, that I cannot think it effectual for determining truth, to examin the ſeveral waies by which Phænomena may be explained, unleſs where there can be a perfect enumeration of all thoſe waies. You know, the proper Method for *inquiring* after the properties of things is, to deduce them from Experiments. And I told you, that the Theory, which I propounded, was evinced to me, not by inferring 'tis thus becauſe not otherwiſe, that is, not by deducing it only from a confutation of contrary ſuppoſitions, but by deriving it from Experiments concluding poſitively and directly. The way therefore to examin it is, by conſidering, whether the Experiments which I propound do prove thoſe parts of the Theory, to which they are applyed; or by proſecuting other Experiments which the Theory may ſuggeſt for its examination. And this I would have done in a due Method; the Laws of *Refraction* being throughly inquired into and determined before the nature of *Colours* be taken into conſideration. It may not be amiſs to proceed according to the *Series* of theſe *Quæries*; which I could wiſh were determined by the Event of proper Experiments; declared by thoſe that may have the curioſity to examin them.

1. Whether rays, that are *alike* incident on the ſame *Medium*, have *unequal* refractions; and how great are the inequalities of their refractions at any incidence?

2. What is the Law according to which each ray is more or leſs refracted; whether it be that the ſame ray is ever refracted according to the ſame *ratio* of the ſines of incidence and refraction; and divers rays, according to divers *ratio's*; or that the refraction of each ray is greater or leſs without any certain rule? *That is*, whether each ray have a certain degree of refrangibility according to which its refraction is performed; or is refracted without that regularity?

3. Where-

3. Whether rays, which are endued with particular degrees of refrangibility, when they are by any means ſeparated, have particular colours conſtantly belonging to them; *viz.* the leaſt refrangible, *Scarlet*; the moſt refrangible, *deep Violet*; the middle, *Sea-green*; and others, other colours? And on the contrary?

4. Whether the colour of any ſort of rays apart may be changed by refraction?

5. Whether colours by coaleſcing do really change one another to produce a new colour, or produce it by mixing only?

6. Whether a due mixture of rays, indued with all variety of colours, produces Light perfectly like that of the Sun, and which hath all the ſame properties, and exhibits the ſame *Phænomena*?

7. Whether the component colours of each mixture be really changed; or be only ſeparated, when from that mixture various colours are produced again by Refraction?

8. Whether there be any other colours produced by refraction than ſuch, as ought to reſult from the colours belonging to the diverſly refrangible rays by their being ſeparated or mixed by that refraction?

To determine by Experiments theſe and ſuch like *Quære's* which involve the propounded Theory, ſeems the moſt proper and direct way to a concluſion. And therefore I could wiſh all objections were ſuſpended, taken from *Hypotheſes* or any other heads than theſe two; Of ſhewing the inſufficiency of Experiments to determine theſe *Quære's* or prove any other parts of my Theory, by aſſigning the flaws and defects in my concluſions drawn from them; Or of producing other Experiments which directly contradict me, if any ſuch may ſeem to occur. For if the Experiments, which I urge, be defective, it cannot be difficult to ſhow the defects; but if valid, then by proving the Theory they muſt render all Objections invalid.

So far this accurate Propoſer; whoſe Method appearing to be moſt genuine and proper to the purpoſe it is propounded for, and deſerving therefore to be conſidered and put to trial by Philoſophers, abroad as well as at home; the Publiſher, to invite and gratify Forraigners, was willing to deliver the above recited Extract of Mr. *Newtons* Letter in the language alſo of the Learned, as followeth;

Excerptum ex *Iſaaci Newtoni* Epiſtola, nuper ad Editorem ſcript, quâ ipſe genuinam ſuggerit Methodum, doctrinam ſuam de *Luc* & *Coloribus*, antehac propoſitam, evincendi, ſubjectâ certorum *Quæſitorum*, debitis Experimentis ſolvendorum, ſerie.

Liceat mihi hac occaſione tibi ſignificare, nequaquam cenſere me, efficacem eam eſſe determinandæ veritatis rationem, quâ diverſi examinantur modi, quibus Phænomena explicari poſſunt, niſi ubi perfecta fuerit omnium iſtorum modorum Enumeratio. Noſti, genuinam proprietates rerum inveſtigandi Methodum eſſe, quâ illæ ab Experimentis deducuntur. Ac jam antè tibi dixeram; Theoriam à me propoſitam evictam mihi fuiſſe, non quidem inferendo rem ita ſe habere quia haud ſe habeat aliter, *i. e. non eam deducendo duntaxat à contrariarum ſuppoſitionum confutatione;* ſed ipſam ab Experimentis, poſitivè & directè concludentibus, derivando. *Vera itaque ratio eam examinandi hæc erit, ſi conſideremus ſcilicet, num Experimenta à me propoſita illas Theoriæ partes, quibus accommodantur, reverà probent; vel ſi alia proſequamur Experimenta, quæ ab ipſa Theoria ad examinandam eam ſuggerantur. Atque hoc ipſum Methodo genuinâ fieri velim; perveſtigatis primum ac determinatis Legibus* Refractionis, *priuſquam* Colorum *natura diſquiratur. Præter rem itaque haud fore crediderim, diſquiſitionem hanc ex ſequentium* Quæſitorum *ſerie inſtituere; quæ quidem ut à ſolertibus ſagacibuſque naturæ Myſtis, pronunciatis Experimentorum Eventibus, dirimantur, in votis quàm maximè habeo. Ea ſunt;*

Primò, *Num radii, qui* æquali *incidentiâ in idem medium incidunt, Refractiones habeant* inæquales; *quantæque ſint refractionum, quas illi ſubeunt, inæqualitates in quavis incidentia?*

Secundò, *Quænam ea Lex ſit, juxta quam radius quilibet magis minúſve refringitur? ſitnè, quòd idem radius ſemper refringatur ſecundùm eandem rationem Sinuum Incidentiæ & Refractionis; diverſi autem radii, ſecundùm rationes diverſas? An verò, quòd cujuſlibet radii refractio major minórve ſit abſque ulla regula certa? Hoc eſt, Utrum unuſquiſque radius certum habeat gradum Refrangibilitatis, juxta quem fiat ipſius refractio; an verò refringatur ſine iſta regularitate?*

Tertiò, *Num radii, certis gradibus refrangibilitatis præditi, quando, quodemum cumque modo, ſecernuntur, certos obtineant colores ipſis proprios; puta radii minimè omnium refrangibiles, Coccineum; maxime refrangibiles, ſaturum Violaceum; intermedii, ſub-Viridem; alii, alios? Et è contrà.*

Quartò, *Num color cujuſvis generis radiorum ſeorſim exiſtentium mutari poſſint Refractione?*

Quintò, *Utrum colores coaleſcendo reverà ſe invicem mutent ad producendum colorem novum; an verò eum producant nonniſi ſe invicem commiſcendo?*

Sextò, *Num debita radiorum miſcela, omnigenâ colorum varietate prædita, Lucem producat Solari luci ſimillimam; quæque eaſdem omninò proprietates obtineat, eademque Phænomena exhibeat?*

Septimò, *Utrum componentes cujuſvis miſcelæ colores reverà mutentur; an verò ſecernantur duntaxat, quando ex mixtura illa varii colores rurſum producuntur per Refractionem?*

Octavò, *Denturne ulli alii colores Refractione producti præter eos, quos oriri oportet à Coloribus, ad radios diverſimodè refrangibiles pertinentibus, dum illi refractione iſtâ ſecernuntur vel miſcentur?*

Per Experimenta determinare hæc ſimiliave Quæſita, quæ propoſitam Theoriam involvunt, maximè genuina directaque videtur ad Concluſionem via: Proindéque omnes velim Objectiones ſuſpendi, quæ ab Hypotheſibus deſumuntur ulliſve Fontibus aliis, quàm his duobus; quibus nempe vel oſtendatur Experimentorum ad determinanda hæc ζητήματα probandaſve ullas alias Theoriæ meæ partes inſufficientia, hallucinationes defectuſque in Concluſionibus meis inde deductis indigitando; vel alia producantur Experimenta, è diametro mihi oppoſita, ſi quæ talia occurrere videantur. Si enim Experimenta, quæ à me urgentur, laborant defectibus, difficile haud fuerit eos oſtendere; ſi veró valida fuerint, eo ipſo dum Theoriam meam aſſerunt probantque omnes Objectiones convellunt.

Some Annotations of the Learned Dr. Walter Needham *upon a Diſcovery pretended to have been made by the famous Monſieur* Pecquet *of a Communication between the* Ductus Thoracicus *and the* Inferior Vena Cava.

The Relation it ſelf of that pretended Diſcovery, as it is to be found in the Journal des Scavans, *of* Feb. 8. 1672.

THE Diſcovery made about twenty years ſince by M. *Pecquet* of the *Ductus Thoracicus*, ſeemed not ſufficient to clear up all the Difficulties to be met with in the New opinion, which this Channel hath occaſion'd, concerning Sanguification.

It might be ſaid among other things, That there appears no reaſon, why Nature, which does nothing without deſign, ſhould carry the matter of the Blood into the *Sub-clavials*, and thence make it deſcend by the Trunck of the *Vena Cava*, (*A*,) unleſs it be to keep the Chyle from entring all at once and altogether pure into the Heart, and that the mixture, which is made of the Chyle with the Blood along this way, may diſpoſe the Chyle, by a kind of contagious fermentation the

The Annotations of Dr. *Needham.*

(A.) I *think the reaſon there mentioned to be very ſufficient for the inſerting of the Trunck of the* Ductus Thoracicus *into one place alone; at leaſt as good as any that are afterwards given to prove the contrary. For, all proofs of this nature are but looſe conjectures at the beſt: the matter admitting of no other demonſtration than what is ocular.*

(B.) *Till the* Lower *inſertion be* ſhewed, *we are bound to believe, that Nature thought the ſingle*

more eaſily to receive the character of the Blood in the Heart: But that this might be more conveniently done, the *Ductus Thoracicus* being inſerted into that trunck of the *Vena cava* which *aſcends* to the Heart, becauſe that this way is ſhorter, and is equally favourable to this commixture.

It might alſo be objected, that, ſuppoſing this commixture were of importance, the *Ductus Thoracicus* ſhould communicate with the *inferior* trunck of the *vena cava* as well as with the *ſuperior*, to the end that the moiety of the Chyle being mixt with the blood that comes from on high, and the other moiety with the blood that comes from beneath, (*B*) it might the more eaſily be altered by this commixture. And this Objection ſeemed the more rational, becauſe, it being very likely that the Blood, which returns from the parts in which it hath received ſome impreſſion in penetrating their poroſities, communicates to the Chyle theſe ſame diſpoſitions; there was reaſon to deſire, that the Blood which re-aſcends might in ſome degree impreſs the peculiar character of the inferior parts, as that, which comes from the upper parts, impreſſes upon it that which belongs to it.

(*C*.) Add hereunto, that the Blood which re-aſcends to the Heart, muſt be more perfect than that which deſcends; becauſe it comes from being purified in the Liver, Spleen, and Kidneys; ſo that it is capable to give (*D*.) to the Chyle good impreſſions.

(*E*.) Laſtly, it might be ſaid, that, ſuppoſing it be neceſſary that not only a portion of the Chyle paſs through the Heart, to give it ſome kind of refreſhment, but alſo that all the Chyle be conveyed thither for to be converted into Blood; the ſmall orifices, which the *ductus thoracicus* hath in the ſubclavials, ſeem not to

commixture of Blood and Chyle ſufficient. The reinforcement of that Objection anſwers it ſelf, being propoſed in no other terms than (it ſeems very likely;) *the whole conjecture having yet had but very ſlender foundation in Philoſophy. And if there be any thing in the notion of impreſſing characters, it is more attributable to the* lympha. *See beneath lit.* D.

(C.) *That the Blood, which re-aſcends to the Heart, is purer than what deſcends from the Head,*&c. *is a notion that will not eaſily be granted, neither can it be made out by Experiment. I have my ſelf compared the Blood of the Jugular vein with that of the Crural in a Dogg, and found no difference. The ſeparations made by the Kidneys and Liver (if they prove any thing) prove the aſcending blood to be thicker than the deſcending; it having loſt in thoſe places much of its* ſerum *and its lixivial ſalts, which are the great inſtruments of attenuation. But withall it is to be conſidered, that the Blood, which aſcends from the Heart to the Head, parts with much excrement in the* glandulæ ſalivales, *and noſtrils, and the whole throat; the quantities of which are much greater than will eaſily be imagined. There is like-*

be large enough for that purpoſe.

(*F.*) The Obſervations, that have been made in the beginning of this year in his *Majeſties Library*, by ſearching carefully the paſſage of the *Ductus Thoracicus* in the Body of a Woman, did ſhew, that theſe difficulties were well grounded. For, it hath been found by divers Experiments, made about this matter, that there *aſcends* at leaſt ſo much Chyle through the Trunck which is beneath the Heart, as there *deſcends* through that which is above it.

Theſe Experiments have appeared conſiderable, in regard that they confirm thoſe, which were alſo made by the ſame *Royal Academy of the Sciences* about five years ſince, and which were inſerted in the 7*th Journal des Scavans* 1667 *. But this laſt Experiment hath been clearer and ampler then the firſt, in that the Communication, which the firſt time appeared to be only with the left *Emulgent* Vein, hath been found this ſecond time not only with *this* vein, but alſo with the two *Lumbary* veins, which are inſerted in the Trunck of the *inferior vena cava.*

As to the manner of proceeding, in the preſence of the whole Company, for finding this Communication, it was this: After there had been ſhewed the Commerce of the *Ductus thoracicus* with the Right Ventricle of the Heart by an injection of Milk, which having been ſyringed into the beginning of this Channel, iſſued in great quantity through this ventricle; we tyed the Trunck of the *vena cava* above the Heart, ſo that nothing might paſs that way; and the Trunck of the *Emulgent* and that of the *Vena Cava* having been opened above long wiſe, ſome milk, ready to boyl, was (*G.*) injected

wiſe a great ſeparation made in the brain; which whether it be of the pureſt and beſt ſpirits of the blood, ſo as to leave it depauperated; or only of a nutritious ſerum, *ſuch as is made in all the ſolid parts, is hard to ſay. Only this may be certainly ſaid, that the* Lympha *does wholly exonerate it ſelf into the ſub-clavial and jugular veins near the place of the inſertion of the* Chyle; *whereby the whole Chyle is diluted, and the mixture of it and the blood facilitated. Which very* phænomenon *is a greater argument to prove, that the Chyle does* wholly *enter by that paſſage, than any can be produced on the other ſide. For we ſee, all the* Lympha, *not only of the Liver and Inteſtines, but alſo of the lower limbs, to powre it ſelf into the* receptaculum chyli, *and not into any of the lower veins: Whereas the Lymphatieks of the Head, Neck and Arms, think it ſufficient to meet the Chyle at the place of its entrance; which ſame thing might have been done by the* lower *Lymphaticks, had they any Chyle to meet: The principal uſe of the* Lympha *ſeeming to be, to ſerve the uſes of the Chyle and its mixture with the Blood.*

(D.) *What impreſſions are made on the Blood by the Liver, Spleen, Kidneys, &c. is* into the *Emulgent* through the left *Lumbary* vein (which we have ever obſerved to come from the *Emulgent*,) and at the ſame time we ſaw it come away through the other *Lumbary*.

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*See *Numb.*25. *of theſe Tracts* p. 461. *where thoſe Experiments were Engliſh't.*

This Experiment having been ſeveral times repeated without our being able to ſee the track, which we had obſerved under the *Pleura*, when the firſt Diſcovery of this Communication was made; which track ſeemed to ſhew the way, which the Thoracick branch keeps to entertain a communication with the *inferior vena cava*: We reſolved to attempt a more eaſie and a more certain method of diſcovering this branch, than the uſual diſſection of the veſſels, performed by ſevering their proper tunicles from a multitude of membranes and fatneſſes, which lying and embaraſſing them, render this work very difficult; eſpecially when the veſſels are not filled with blood to make them viſible, and becauſe they are compoſed of more delicate tunicles, than thoſe of the Veins.

(H.) This way was, to ſyringe into the Trunck of the *ductus thoracicus* a Compoſition, that might run into it being hot, and which by being refrigerated might become ſolid enough to afford a greater facility to follow and trace the channels, in the cavity of which it ſhould be thus hardened. And this deſign ſucceeded in part. For, the Compoſition filled the whole *ductus thoracicus*, and aſcended as far as into the *ſub-clavial*; but there paſſed nothing into the channel that makes the communication ſought for, though care was had to warm the ambient parts by ſeveral injections of warm milk, to the end that the Compoſition might not harden before it had penetrated into all the conduits. We alſo tryed to inject the ſame Compoſition through the *Lumbary* that iſſues out of the Trunck, if its valves would permit it; but *they* ſtopped all that we endeavoured

uncertain: But if there be any ſuch made, the Liver and Kidneys do ſo readily exonerate themſelves into the vena cava, *that the impreſſions, be they what they will, are quickly conveyed to the Heart without any great diminution of them. And whereas the Author mentions the characters impreſſed from parts; thoſe, (if any ſuch be) may more juſtly be ſuppoſed to be conveyed in the* lympha, *which liquor ſeems to be a product of thoſe parts curiouſly elaborated in the very ſubſtance of them.*

(E.) *What is ſufficient and not ſufficient, muſt be judged of by Nature, and not by Us. Yet, if we conſider the time that is ſpent in carrying the Chyle up into the Blood, it is eaſie to believe, that a much greater quantity of liquor may be diſcharged by that* ductus, *than is uſually pretended to.*

(F.) *What thoſe Experiments are, we ſhould be glad to know. But the Experiment of* 1667 *(if I rightly remember it) was only a* luſus naturæ, *found by M.* Pecquet. *Which I therefore call ſo, becauſe neither he, nor any one elſe hath found it ſince: whereas the* vaſa lactea, *and the waies of ordering them, are ſo well known, that, if any ſuch thing were, it could not long be hid.*

(G.) *An Injection into the* Lumbary *vein with its effects* to make paſs that way, and neither the milk nor the wind would ever enter there.

(J.) The advantage we had from the Injection of this Compoſition into the ſaid *Ductus*, was, that we very diſtinctly ſaw the figure and the whole ſtructure of it, when the Compoſition wherewith it had been filled, was refrigerated and hardned. For we found, *that* that *ductus* did aſcend unto the right ſide of the heart, keeping one and the ſame ſize, which was no more than $\frac{1}{12}$ of an inch; *that* afterwards it was enlarged to $\frac{1}{6}$ of an inch in diameter; *that* in this enlargement its tunicle on the right ſide of the *vertebræ* was, as 'twere, pierced by four ſmall holes, diſtant $\frac{1}{12}$ of an inch from one another, and all diſpoſed in a row; into which holes the ſaid Compoſition had not been able to penetrate; *that* the ſame *ductus*, after having retaken its firſt ſize, had two appendixes faſhioned like ſacks; *that* there was yet a third appendix beneath the dilatation; *that* the firſt and higheſt appendix was of the form and bigneſs of a ſmall phaſeolus; *that* the third, which was beneath the dilatation, was like to the ſecond; *that* they had all a ſtreight orifice; and *that* the laſt was full of chyle conſpiſſate, ſo that the Compoſition could not enter there, as it had done into the other.

The Importance of theſe Obſervations ought to incite the Curioſity of thoſe that are addicted to Anatomical reſearches, and to engage them to examin with care this New communication, to attain at laſt a clear accompt thereof.

effects mentioned can prove nothing but the Inoſculation of the two Lumbary *veins with each other: which is acknowledged to be ſuch in all the Capillary veſſels of the ſame kind,* viz. *Veins with veins, and Arteries with arteries. But the thing required here is, the paſſage from the* Receptaculum *to the* Lumbary *vein, or to any other vein beſides the* Subclavial.

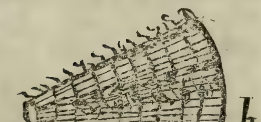
(H) *The way of ſyringing a liquor, which is apt to coagulation, into the* ductus thoracicus, *&c I think to be needleſs and unprofitable as to this Inquiry, when there is a more eaſie Experiment to be made, which is more demonſtrative,* viz. *Open a Dog at a convenient diſtance of time from his feeding, and then tye a ligature upon the* ductus thoracicus *nigh the Sub-clavial: your* receptaculum chyli *will continue full, 48 hours or longer, if you pleaſe: So that, if there be any ſuch* ductus, *it muſt remain likewiſe full with its own natural liquor, and be all that while viſible. But, if there were any ſuch* ductus, *it would in a quarter of the time empty the whole receptacle; whereas upon a ligature you'l find the clean contrary,* viz *all the Lacteal veſſels (that are acknowledged to be ſuch,) fully diſtended: Which is a full demonſtration, that they have no way of evacuation by any other duct than the thoracique.*

(J.) *The other uſe of the coagulating Injection I applaud; though the ſame may be done by the Ligature abovesaid. However the event of the Experiment, made by the Learned* Pecquet, *makes againſt the opinion of a New* ductus, *and not for it; as appears by the Narrative.*

The haſte, in which this was written, begs your excuſe.

A Second Letter of P. *Pardies*, written to the Publiſher from *Paris* *May* 21. 1672. to Mr. *Newtons* Anſwer, made to his firſt Letter, printed in *Numb.* 84.

R*Edditæ mihi ſunt tuæ literæ cum Obſervationibus Clariſſimi atque Ingenioſſimi* Newtoni, *quibus ad meas difficultates reſpondit. Eas ego legi non ſine maxima voluptate : Et primùm, quod attinet ad ipſum Experimentum majoris Latitudinis colorum quàm exigeret vulgaris Theoria Refractionum ; fateor, me* inæquales *refractiones in oppoſitis Priſmatis faciebus ſuppoſuiſſe, nec ulla tenus advertiſſe in literis relatis in* Tranſactionibus, *obſervatam fuiſſe à* Newtono *majorem illam latitudinem in eo caſu in quo refractiones ponerentur reciprocè* æquales, *eo modo quo hîc in iſtis obſervationibus dicitur. Sed nec ab eo tempore in iiſdem* Tranſactionibus *videre licuit, cùm eas non potuerim recuperare. Cùm igitur nunc videam, etiam in eo Caſu obſervatam majorem illam Colorum latitudinem ; certè ex hoc capite nihil mihi ulterius reſtat difficultatis : Ex hoc, inquam, capite ; nam aliundè videtur poſſe reddi ratio illius Phænomeni abſque iſta varia Radiorum Refrangibilitate. Etenim in ea Hypotheſi, quam fuſè explicat noſter* Grimaldus, *in qua ſupponitur Lumen eſſe ſubſtantia quædam rapidiſſimè mota, poſſet fieri aliqua diffuſio luminis poſt tranſitum foraminis & decuſſationem radiorum.* Item *in ea Hypotheſi, qua lumen ponitur progredi per certas quaſdam materiæ ſubtilis Undulationes, ut explicat ſubtiliſſimus* Hookius, *poſſunt explicari colores per certam quandam diffuſionem atque expanſionem Undulationum, quæ fiat ad latera radiorum ultra foramen, ipſo contagio ipſaque materiæ continuatione. Certe ego talem adhibeo hypotheſin in* Diſſertatione de motu undulationis, *quæ eſt ſexta pars meorum Mechanicorum ; ut ponam, colores iſtos apparentes fieri ex ſola illa Communicatione motionis, quæ ab Undulationibus directè procedentibus ad latera effundatur : Ut, ſi radii intrantes per foramen* a *progrediantur verſùs* b, *undulationes quidem directè terminari deberent (habendo rationem ad motum rectum & naturalem) ad lineam rectam* a b ; *nihilominus tamen, propter continuitatem materiæ, fit aliqua communicatio commotionis verſus latera* c c, *ubi tremula quædam & criſpans ſuccuſſio excitatur : Atque ſi in illa laterali criſpatione conſiſtere colores ſupponatur, exiſtimo omnia phænomena colorum explicari poſſe, ut fuſius in ea, quam dixi, Diſſertatione expono. Quibus item poſitis apparet etiam, cur ultra quàm ferat radiorum ipſorum divaricatio, expandi colorum latitudinem neceſſe ſit. Verum iſta obiter hîc tantum ad notaſſe ſufficiat.*



Quod annotat, errorem, qui oriri poſſet in calculo, ex eo, quod dixeram, veluti foramine facto in poſteriori facie priſmatis; errorem, inquam, illum non poſſe inducere ſenſibilem varietatem: id optimè annotatum eſt; neque ego exiſtimavi, inde multum augeri colorum latitudinem, ſed tantummodò accuratam calculi rationem indicare volui: Quapropter etiam & ego in praxi negligendam hanc cautionem cenſeo.

Circa Experimentum crucis, *nequaquam dubito, quo minus in ſuo experimento talem ſitum adhibuerit, in quo* æqualis *inclinatio fuerit Radiorum incidentium; quandoquidem id ita à ſe præſtitum expreſſè affirmat. Verùm id non ego poteram conijcere ex iis quæ in* Tranſactionibus *legeram; ubi ponuntur duo exigua & maximè diſtantia foramina, & unum Priſma prope* primum *foramen quod eſt in feneſtra; per quod Priſma radij colorati erumpentes incidunt in alterum diſtans foramen. Addebatur autem, quòd ad hoc ut omnes illi radii ſucceſſivè inciderent in* ſecundum *illud foramen, convertebatur primum Priſma ſupra axem: Atqui hoc modo neceſſe eſt mutari inclinationem radiorum qui incidunt in ſecundum foramen: atque indicavi ego in literis, quòd perinde ſe ſe res haberet, ſive manente primo Priſmate immobili, ſecundum foramen attolleretur aut deprimeretur, ut poſſet ſucceſſivè radios omnes depictæ imaginis Solaris excipere; ſive manente iſto ſecundo foramine immobili, primum priſma converteretur, ut ita eadem imago ſitum mutaret, atque in foramen impingere ſecundum omnes ſucceſſivè partes poſſet. Sed alias ſine dubio adhibuit cautiones ſolertiſſimus* Newtonus.

Quæ circa Colores *objeceram, optimè ſoluta exiſtimo. Quod autem* Theoriam *iſtam, appellarim* Hypotheſin, *id certè ego nullo adhibito conſilio feci; atque nomen uſurpavi quod primum occurrit: quapropter velim ut ne per contemptum adhibitam vocem ejuſmodi exiſtimet. Præclara ſanè inventa ſemper ego magni feci, Clariſſimum verò* Newtonum *imprimis ſuſpicio ac veneror.*

Mr. *Newtons* Anſwer to the foregoing Letter.

IN *Obſervationibus R. Patris* J. Pardies, *quas ad te denuò conſcripſit, an majus ſit Humanitatis argumentum quòd meis reſponſionibus vim omnem attribuit; an Ingenii, quòd Objectiones proponit, quæ, ſi non probe tollantur, Doctrinam noſtram fruſtrari poſſint, vix dixerim. Vtrumque ſanè ad determinandam veritatem optimè conducit, efficitque ut acceptis quàm lubentiſſimè reſpondeam.*

Ait R. P. quòd abſque *varia diverſorum radiorum refrangibilitate poſſibile ſit explicare longitudinem colorum; puta ex Hypotheſi P.* Grimaldi, *per diffuſionem luminis, quod ſupponitur eſſe ſubſtantia quædam rapidiſſimè mota; vel ex Hypotheſi* Hookii *noſtri, per diffuſionem vel expanſionem Vndulationum, quas ſtatuit in æthere à lucidis corporibus excitatas quaquaverſum propagari. Addo, quòd ex Hypotheſi* Carteſiana *poteſt etiam effingi conſimilis diffuſio conatus vel preſſionis globulorum, perinde ut in explicatione* Caudæ Cometæ *ſupponitur. Et eadem diffuſio vel expanſio juxta aliam quamvis Hypotheſin, in qua lumen ſtatuitur eſſe vis, actio, qualitas, vel ſubſtantia qualibet à luminoſis corporibus undique emiſſa, effingi poteſt.*

Vt his reſpondeam, animadvertendum eſt, quòd Doctrina illa, quam de Refractione & Coloribus explicui, in quibuſdam Lucis Proprietatibus *ſolummodo conſtitit, neglectis* Hypotheſibus *per quas Proprietates illæ explicari debent. Optimus enim & tutiſſimus philoſophandi modus videtur, ut imprimis rerum proprietates diligenter inquiramus & per experimenta ſtabiliamus; ac dein tardius contendamus ad Hypotheſes pro earum explicatione. Nam* Hypotheſes *ad explicandas rerum proprietates tantùm accommodari debent, & non ad determinandas uſurpari, niſi quatenus experimenta ſubminiſtrare poſſint. Et ſiquis ex ſola* Hypotheſium *poſſibilitate de veritate rerum conjecturam faciat, non video quo pacto quicquam certi in ulla ſcientia determinare poſſit; ſiquidem alias atque alias Hypotheſes ſemper liceat excogitare, quæ novas difficultates ſuppeditare videbuntur. Quamobrem ab* Hypotheſium *contemplatione, tanquam improprio argumentandi loco, hîc abſtinendum eſſe cenſui, & vim Objectionis abſtrahendam, ut pleniorem & magis generalem reſponſionem accipiat.*

Itaque per Lumen *intelligo quodlibet Ens vel entis poteſtatem (ſive ſit ſubſtantia, ſive quævis ejus vis, actio, vel qualitas) quod à corpore lucido rectà pergens aptum ſit ad excitandam viſionem; & per* radios *Luminis intelligo minimas vel quaslibet indefinitè parvas ejus partes, quæ ab invicem non dependent; quales ſunt illi omnes radii, quos lucentia corpora vel ſimul vel ſucceſſivè ſecundùm rectas lineas emittunt. Nam illæ tum collaterales tum ſucceſſivæ partes luminis ſunt independentes; ſiquidem una abſque aliis intercipi poſſint, & in quaslibet plagas ſeorſim reflecti vel refringi. Et hoc præcognito, Objectionis vis omnis in eo ſita erit; Quòd colores per aliquam Luminis ultra foramen diffuſionem, quæ non oritur ab inæ-*

quali diverſorum radiorum (ſeu luminis independentium partium) refrangibilitate, in longum diduci poſſint.

Quòd autem non aliunde oblongentur, monſtravi in Literis relatis in Phil. Tranſactionibus, Num. 80. *Et ut rationes facilius percipiantur, non gravabor jam fuſius explicare.*

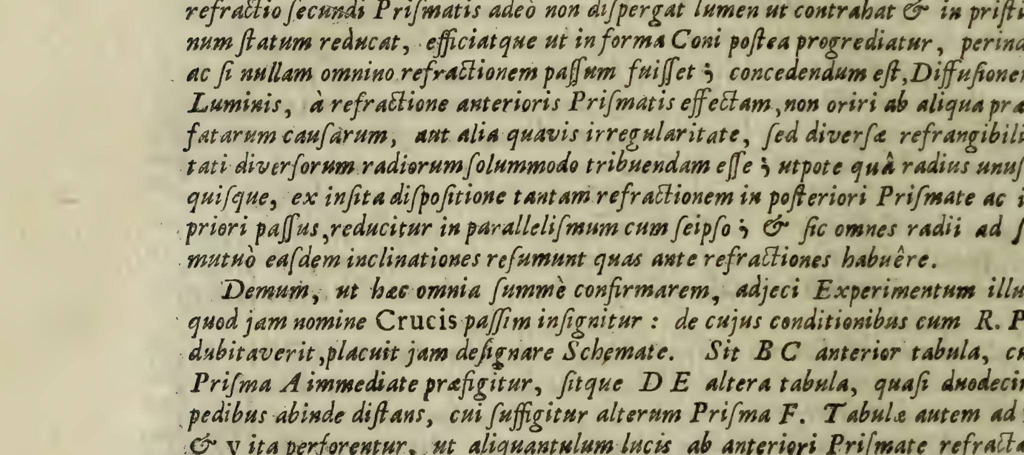
Scilicet ex obſervatione, quòd radii poſt refractionem non incurvabantur, ſed rectâ ad parietem progreſſi fuêre, patuit, eandem fuiſſe eorum ad ſe mutuò inclinationem cùm modò exiêrunt Priſmate, atque cùm impegerunt in parietem; & proinde Longitudo colorum ex inclinatione radiorum emerſit quam inter refringendum obtinuêre, hoc eſt, ex quantitate refractionis quam ſinguli radii in Priſmate patiebantur: Adeóque cùm colorum longitudo latitudinem aliquot vicibus ex obſervatione ſuperavit, ſequitur, majorem fuiſſe inæqualitem refractionum quàm potuit oriri ex inæqualitate incidentiarum. Quin imò ex figura imaginis coloratæ, quòd nempe non fuit Ovalis, ſed ad latera duabus parallelis rectis lineis terminata, patuit, eam ex indefinitè multis imaginibus Solis, per inæqualem refractionem in longum diſtractis, & ſerie continuâ diſpoſitis, conſtitui; adeoque radios à ſingulis partibus ſolaris Diſci provenientes per totam ferè longitudinem colorum diſpergi; & proinde ſimiliter incidentium inæquales eſſe refractiones. Id quod aliis etiam indiciis oſtendi poſſet.

Conſtat itaque diverſas eſſe refractiones, ubi pares ſunt incidentiæ. Sed amplius inquirendum eſt, Vnde oriatur illa diverſitas; An ſit à cauſa aliqua incerta & irregulari, vel certâ lege, ſecundùm quam radius quilibet aptus eſt determinatam aliquam refractionem pati. Per incertas & irregulares cauſas intellige aſperitates in ſuperficie, vel venas diverſæ denſitatis in interiori parte vitri ex quo Priſma conflatur; item irregularem ſitum pororum, quos nonnulli ob luminis tranſmiſſionem directo tramite per vitrum omnifariam traijci ſtatuunt; nec non tremores & inæquales commotiones partium ætheris, aëris, vel vitri; radiorum in refringente ſuperficie ſe mutuò fortaſſe comprimentium reſulturam ab invicem; ejuſdem cujuſque radii diviſionem ac diſſipationem in partes divergentes, quas vel numero finitas vel indefinitè multas in ſuperficie aliquâ continuatim jacentes imaginari liceat; vel quamvis aliam diffuſionem & dilatationem Luminis quam poſſumus excogitare, non ortam ex diverſa prædiſpoſitione cujuſque radii ad refractionem, in certo aliquo & conſtanti gradu patiendam.

Quod autem diverſa refractio non orta ſit ex ullis ejuſmodi cauſis incertis & irregularibus, probavi per Experimentum duorum conſimilium Priſmatum in contrario ſitu juxta-poſitorum, ita ut poſterius contrariâ ſuâ refractione retro-flecteret radios, & ſic regulares effectus prioris deſtrueret, ſed per iteratas refractiones augeret irregulares. Vtpote ſi prius Priſma diffunderet ac divergere faceret parallelos radios; e.g. per aſperam polituram, inæquabilem denſitatem, aut irregularem ſitum pororum Priſmatis; vel per tremulos motus partium ætheris, aëris aut vitri; vel per dilatationem luminis propter partium ejus (i.e. radiorum) ſe mutuò comprimentium relaxationem verſùs adjacentia ſpatia, quæ vel nullo vel minùs conſtipato lumine irradiantur;

vel deniqùe per cujuſque radii dilatationem aut diffractionem in complures divergentes radios: tum ſanè poſterius Priſma magis diffunderet ac diſſiparet radios per dictas irregularitates ætheris, aëris, aut vitri, vel per iteratam dilatationem luminis à refringentis ſuperficiei reſiſtentia denuò conſtipati ac diffuſi, vel etiam per cujuſque radii à priori diffractione orti iteratam diffractionem ac diviſionem in longè plures divergentes radios. Et ſic Lumen magis diſpergeretur per refractionem ſecundi Priſmatis, & in parietem projectam Imaginem duplo longiorem minimùm exhiberet, quàm per ſolam refractionem prioris Priſmatis exhiberi potuiſſet. Quamobrem cùm, experientiâ teſte, refractio ſecundi Priſmatis adeò non diſpergat lumen ut contrahat & in priſtinum ſtatum reducat, efficiatque ut in forma Coni poſtea progrediatur, perinde ac ſi nullam omnino refractionem paſſum fuiſſet; concedendum eſt, Diffuſionem Luminis, à refractione anterioris Priſmatis effectam, non oriri ab aliqua præfatarum cauſarum, aut alia quavis irregularitate, ſed diverſæ refrangibilitati diverſorum radiorum ſolummodo tribuendam eſſe; utpote quâ radius unuſquiſque, ex inſita diſpoſitione tantam refractionem in poſteriori Priſmate ac in priori paſſus, reducitur in paralleliſmum cum ſeipſo; & ſic omnes radii ad ſe mutuò eaſdem inclinationes reſumunt quas ante refractiones habuêre.

Demum, ut hæc omnia ſummè confirmarem, adjeci Experimentum illud quod jam nomine Crucis *paſſim inſignitur: de cujus conditionibus cum R. P. dubitaverit, placuit jam deſignare Schemate. Sit B C anterior tabula, cui Priſma A immediate præfigitur, ſitque D E altera tabula, quaſi duodecim pedibus abinde diſtans, cui ſuffigitur alterum Priſma F. Tabulæ autem ad* x *&* y *ita perforentur, ut aliquantulum lucis ab anteriori Priſmate refracta, traijci poſſit per utrumque foramen ad ſecundum Priſma, inque eo denuò refringi. Jam Priſma anterius circa axem reciproco motu convertatur, & colores in Tabulam poſteriorem D E procidentes, per vices attollentur ac deprimentur, eoque pacto alius atque alius color ſucceſſivè pro arbitrio traijci poteſt per foramen ejus* y *ad poſterius Priſma, dum cæteri colores in Tabulam impingunt: Et videbis, radios diverſis coloribus præditos diverſam pati refractionem*



nem in illo poſteriori Priſmate, ex eo quòd ad diverſa loca parietis vel cujuſvis obſtaculi G H, pedibus aliquot ulterius remoti, allabentur; puta violacei *radii ad H,* rubri *ad G, &* intermedii *ad loca intermedia: & tamen propter determinatam poſitionem foraminum neceſſe eſt ut ſimilis ſit incidentia radiorum cujuſque coloris per utrumque trajecti. Atque ita ex menſura conſtat radios, diverſis coloribus affectos, habere diverſas leges refractionum.*

Sed ſuſpicor unde adductus ſit R.P. in dubitationem; nempe videtur collocaſſe primum *Priſma A* poſt *Tabulam B C, atque ita convertendo circa Axem, veriſimile eſt inclinationem radiorum qui interjacent foramina propter intermediam refractionem fuiſſe mutatam. At ex deſcriptione expoſitâ in* Phil. Tranſactionibus *debuit Tabula illa collocari* poſt *Priſma, ut radii inter foramina in directum jacerent, quemadmodum ex verbis;* I took two Boards and placed one of them cloſe behind the Priſm at the Window *, *conſtare poteſt. Et uſus Experimenti idem innuit.*

* *Vid. Num.* 80. *p.*3078. *quæ verba Latinè ita ſonant;* Capiebam duas Tabulas ligneas, unamque earum immediatè collocabam *poſt* Priſma ad feneſtram.

Ex abundanti placet obſervare, quòd in hoc Experimento colorata Lux ob refractionem ſecundi Priſmatis longe minùs diffunditur ac divaricat, quàm cùm alba exiſtit, adeò ut imago ad G vel H ſit penè circularis; præſertim ſi Priſmata ſtatuantur parallela & in contrario ſitu angulorum, prout in Schemate deſignantur. Quinetiam, ſi præterea diameter foraminis y *adæquet latitudinem colorum, nulla erit ejuſdem coloratæ lucis in longum diffuſio; ſed imago, quæ à quopiam colore ad G vel H effingitur, (poſitis circularibus foraminibus, & refractione poſterioris Priſmatis non majori quàm prioris, radiiſque ad obſtaculum quàm proximè perpendicularibus,) erit planè circularis. Id quod arguit diffuſionem, de qua ſupra egimus, non ex contagione vel continuitate materiæ undulantis aut celerrimè motæ vel ſimilibus cauſis ortam eſſe; ſed ex certa refractionum cujuſque generis radiorum lege. Cur autem Imago illa in uno caſu ſit circularis, & in aliis nonnihil oblongata, & quomodo diffuſio lucis in longitudinem in quolibet caſu pro arbitrio minui poſſit, à Geometris determinandum & cum experientia conferendum relinquo.*

Poſtquam Proprietates Lucis *his & ſimilibus experimentis ſatis exploratæ fuerint, ſpectando radios tanquam ejus ſive collaterales ſive ſucceſſivas partes, de quibus experti ſimus per independentiam quod ſint ab invicem diſtinctæ; Hypotheſes exinde dijudicandæ ſunt, & quæ non poſſunt conciliari reijciendæ. Sed leviſſimi negotii eſt, accommodare Hypotheſes ad hanc Doctrinam. Nam ſiquis Hypotheſin* Carteſianam *defendere velit, dicendum eſt, globulos eſſe inæquales; vel preſſiones globulorum eſſe alias aliis fortiores, & inde diverſimodè refrangibiles, & aptas ad excitandam ſenſationem diverſorum colorum. Et ſic juxta Hypotheſin* Cl. Hookii *dicendum eſt, Undulationes ætheris eſſe alias majores ſive craſſiores aliis. Atque ita in cæteris. Hæc enim videtur eſſe ſummè neceſſaria Lex & Conditio* Hypotheſium, *in quibus Naturalia corpora ponuntur conſtare ex quàm plurimis corpuſculis acervatim contextis, ut à diverſis lucentium corpuſculis, vel ejuſdem corpuſculi diverſis partibus (prout motu figurâ, mole, aut aliis qualitatibus differunt) inæquales preſſiones, motiones* *aut mota corpuſcula per æthera quaquaverſum traijciantur, ex quibus, confuſè miſtis, lux conſtitui ſupponetur. Et nihil durius eſſe poteſt in iſtis Hypotheſibus quàm contraria ſuppoſitio.*

Ex apertura ſive dilatatione Lucis in poſteriori facie Priſmatis, quam R. P. dixit eſſe veluti foramen, ſufficit, quod error non emerget ſenſibilis ſi modò aliquis emergeret. Quòd ſi calculus juxta Obſervationes præcisè ineatur, error erit nullus. Nam diametro foraminis à longitudine Imaginis ſubductâ, reſtabit longitudo quam Imago haberet ſi modò foramen ante Priſma eſſet indiviſibile, idque non obſtante præfatâ lucis dilatatione in poſteriori facie Priſmatis; ut facile oſtenditur. Deinde ex data illa longitudine Imaginis, ac diſtantia à foramine indiviſibili, ut & poſitione & forma Priſmatis, & ad id inclinatione incidentium radiorum, ac angulo, quem refracti radii, ad medium Imaginis tendentes, cum à centro Solis incidentibus conſtituunt, cætera omnia determinantur. Et quæ determinant refractiones & poſitiones radiorum, ſufficiunt ad calculum iſtarum refractionum ritè ineundum. Sed res non tanti eſſe videtur ut moram inferat.

Quòd R.P. Doctrinam noſtram Hypotheſin *vocaverit, non aliunde factum eſſe credo quàm quòd vocabulum uſurpavit quod primùm occurrit; ſiquidem mos obtinuit ut quicquid exponitur in Philoſophia dicatur Hypotheſis. Et ego ſane non alio conſilio vocabulum iſtud reprehendi quàm ut nè invaleſceret appellatio quæ rectè Philoſophantibus præjudicio eſſe poſſet. R. Patris verò candor in omnibus conſpicitur; indeque modus efferendi Benevolentiam, qui mihi minimè convenit. Quod tamen noſtra non diſplicent, vehementer gaudeo. Vale. Dab.* Cantabrig. 11mo Junii 1672.

Hæc reſponſio ad R.P. Ignatium Pardies *mox tranſmiſſa id effecit, ut ille die* 9. Julii 1672. *reſcriberet Gallicè in hunc ſenſum;*

Omnino mihi ſatisfecit noviſſima reſponſio, à Dn. *Newtono* ad meas Inſtantias data. Noviſſimus ſcrupulus, qui mihi hærebat circa *Experimentum Crucis*, penitus fuit exemptus. Atque nunc planè ex Figura ipſius intelligo quod non intellexeram ante. Experimentum peractum cùm fuerit iſto modo, nil habeo quod in eo deſiderem ampliùs. Rem mihi pergratam feceris, ſi ipſi ſingularem meum ingenii & doctrinæ ejus cultum conteſteris, & pro illo ſtudio maximas gratias agas, quo voluit Annotationes meas examinare iiſque reſpondere. Præter exiſtimationem illam, quam jam ante de acumine ejus conceperam, affectus hic officioſus magnopere me ipſi devinxit.

An Accompt of ſome Books.

I. *SCARBROVHG SPAW Spagyrically Anatomized, An.* 1670; *And a NEW-YEARS-GVIFT for Dr.* Witty; London 1671: *Both in* 12°. *by* George Tonſtal *Doct. of Phyſick.*

THE Examination of Medical waters being ſo uſeful *both* for the improvement of Phyſiology, *and* the Relief of the Health of man; we cannot but take publick notice in theſe Tracts of the diſcourſes of that Subject, that come abroad by the Preſs: wiſhing only, that the Examiners of ſuch matters, as well as of all others, would conſider them without partiality and invectives, with all poſſible care and ſincerity; thereby to ſtock the Philoſophical Magazeen, that is now every where a furniſhing by Experimental Philoſophers, with ſuch obſervations as commend themſelves by their Truth and Exactneſs: For the finding out of which in the matter of the *Scarbrough Spaw*, treated of in theſe two pieces, and controverted between their Author and *Dr. Witty*; it ſeems to be very neceſſary to commit the examination of what they both have deliver'd thereon to ſome as well impartial as intelligent Naturaliſts, to review what they have written, and to repeat the Trials they have made, the better to enable themſelves to decide the diſpute.

In the mean time it may not be amiſs to give ſome account here *both* of the ſtate of the Controverſy, as 'tis delivered in theſe two diſcourſes, *and* of the Aſſertions made by Dr. *Tonſtal* concerning theſe waters.

The Controverſy is, whether the *Scarbrough-Spaw* do contain for Ingredients, *Particles* of *Stone*, a *Nitro-aluminous Salt*, and a *Glebe* of *Allom*; and conſequently be apt, upon the account of that Stone-Powder and clay, to breed the Stone? This is denyed by Dr. *Witty*, who judgeth its material principles to be cheifly, *Allom, Nitre*, and *Vitriol of Iron* which he ſaith he hath extracted out of it. Whereas Dr. *Tonſtal* poſitively affirms, that the *Scarbrough-water* hath no vitriol or iron in it, but a Stone-powder, and a clay, leaving ſand at the bottom of the

Veſſel, when it is boiled, like the dropping well at *Knaiſborough*; and that conſequently it hath a Lapideſcent Juice, and therefore is petrifying, and bad for the Stone, Gout, and Jaundice: maintaining, that that which Dr. *Witty* calls a little inſipid earth, (remaining upon the diſſolution of the firſt extract of this Spaw, and the filtration of it) is a great deal of gretty Stone-powder; and adding further, that 'tis the peculiar Character of the ſame Spaw, whereby it is diſtinguiſh't from other Spaws in uſe, to take a reſty fit ſooner or later, ſo as that it will neither go backward nor forward, by ſiege or urine.

Having made it his buſineſs to prove this both by a Chymical Analyſis, and by Experience of his own and others, importing that they never had any fit of the Stone till he and they drank of this *Scarbrough*-water; he further obſerveth,

1. That *Allom-Stone* diſſolved in water yields a Purple tincture by *Gall*; and that, this Allom ſtone being acknowledged by Dr. *Witty* to be in *Scarbrough*, therefore the Tincture by Gall is no argument for *Vitriol* in that Spaw.

2. That all waters that have diſſolved Iron, have Vitriol alſo as the product of that diſſolution.

3 That all the Salt that ſprouts out of the Scarbrough-cliff, is Nitro-alluminous, and not Vitriol.

4. That the precipitated powder found at the bottom of the veſſel, after that *Scarbrough* water hath ſtood in it two or three dayes, is Glebe of *Allom*.

5. That if Vitriol be joyned with Niter in *Scarbrough* (as Dr. *Witty* will have it) it becoms a corroſive water, whereby (ſaith Dr. *Tonſtal*) it would be made worſe than by all he hath written againſt it.

Whilſt our Author is thus examining the *Scarbrough-Spaw*, he taketh occaſion to ſay thus much of that of *Knaiſvorough*, that its worth and excellency is, that an Embryonate Sulphur hath corroded Iron in it; which, *ſaith he*, makes it Stomachical, Opening, Diuretical, and ſtrengthening all the noble parts.

Having thus repreſented the ſum and ſubſtance of what Dr. *Tonſtal* hath alledged againſt Dr. *Witty* upon this *Spaw*; we wiſh for further examination of this water, to be undertaken in an amicable and unbiaſſed way, and by the conjunction of ſome able and diſcreet Perſons with theſe two diſputants, that have hitherto very unbecommingly inveighed againſt one another.

II. *NEW-ENGLANDS RARITIES diſcover'd; together with the Remedies uſed by the Natives to cure their Diſeaſes, Wounds and Sores,* &c. *By* John Joſſelin *Gent.* London 1672. *in* 12°.

THeſe Obſervations are the fruits of the Authors eight years travel in *New-England*: They concern (beſides the Geography of that Country, and the temperature of the Air, and the moſt common Diſeaſes) the natural Productions of that Engliſh Plantation: And thoſe 1 *Animals*; *viz.* Birds, Beaſts, Fiſhes, Serpents, Inſects: 2 *Plants*, and theſe *either* ſuch as are common with us; *or* proper to that Country, both with, and without names; *or* ſuch as have ſprung up ſince the *Engliſh* planted there; *or* laſtly ſuch Garden-herbs (amongſt us,) as do thrive there, and of ſuch as do not. 3. *Foſſils*, as Stones, Minerals, Metals, and Earths.

To make theſe Obſervations of Nature the more conſiderable and uſeful, the Obſerver ſubjoins to them their reſpective uſes in Phyſick, Chirurgery, Dying, *&c* e.g. To cure conſumptions by eating *Land-Turtles:* To heal Scalds and Burns with the Oyl of the *Sea-Calf*; or with a ſtrong decoction of *Tobacco*, waſhing the Sore therewith, and ſtrewing *Tobacco-powder* thereon: To heal Bruiſes and Aches with the Oyl of the *Sperma-ceti-Whale*; which, *ſaith the Author,* being put up into Hogſheads, and ſtow'd into Cellars for ſome time, candieth at the bottom about one quarter, and then the oyl being drawn off of the candied ſtuff, put up into convenient veſſels, proveth to be right *Sperma-Ceti,* and is ſold for ſuch, being admirable for the already mention'd uſes: *Item*, To remedy the biting of a Ratle-Snake by bruiſing its Liver and applying it to the wound: To ſtrengthen the Limbs by anointing them with an Oyl, drawn out of the white Oak acorns, boiled in a *Lixivium* made of the Aſhes of rotten Maple-wood, untill the Oyl ſwim on the top, which is ſo clear and ſweet, that the *Indi*-

ans eat it alſo with their meat: To heal bruiſed Limbs and Cuts with the bark of Birch, boyled very tender, and ſtamped between two *Stones* to be a plaiſter, and the decoction thereof powred into the wound: To take off a Pin or web, or any kind of film growing over the eye with the calcin'd and pulverized ſhell of a *Sheath-fiſh*, which is very plentiful in *New-England*; a delicate fiſh, cover'd with a thin ſhell and of the colour of a Muſle.

Among the *Animals*, there are ſome that deſerve to be taken notice of above the reſt; as 1. A *Dear*, call'd the *Mooſe-dear*, ſome of which are deſcribed to be twelve foot high, with exceeding fair Horns with broad palms; ſome of them two fathoms from the tip of one Horn to the other: They have commonly three *Fawns* at a time, which are, to our Obſervers Palate, an incomparable diſh. 2. A monſtrous great Bird, call'd *Pilhannaw* or *Mechquan*, a kind of Hawk, four times as big as a Goſ-Hawk, with a head as big as a Childs of a year old, a very Princely Bird; at whoſe ſoaring abroad, all ſorts of feather'd creatures hide themſelves; though ſhe never preys upon any of them, but doth upon *Fawns* and *Jaccals*. 3. The *Scarlet-Muſlle*, having a purple-vein, which being prick't with a needle yeilds a perfect Purple or Scarlet Juyce that will not be waſht out of the Linnen died therewith; found at *Paſchatawey*, a Plantation about 50 Leagues by Sea Eaſt-ward from *Boſton*, in a ſmall *Cove*, call'd *Bakers Cove*. 4. A little Beaſt call'd a *Muskquaſh*, feeding upon the baſtard *Calamus Aromaticus*, hath Cods ſenting that as ſweet and ſtrong as Musk, and laſting thus a long time, wrapt up in Cotton-wool.

Among *Plants* there is one, taken by ſome to be a kind of *Golden-Rod*, by others for *Sarazens Conſound*, by the Author for a kind of *Sun-flower*, or Weſt-Indian *Marigold*; of which the ſtalk beneath and above the knob is cover'd with a multitude of ſmall Bugs, about the bickneſs of a great Flea, which order'd as they ſhould be before they come to have wings, the Obſerver preſumes will make good *Cochineel*; they yeilding a perfect and durable Scarlet-colour.

The New England *Peaſe* are ſaid by our Author not only to be the beſt in the world, but free from being worm-eaten.

Rue he noteth for an herbe hardly growing there; *Roſe-Mary, Lavender, Southern-wood,* not at all; *Blood-wort* and *Celondine,* but ſorrily; *Muskmelons* better than in old England, &c.

III. *A Rational way of preparing ANIMALS, VEGETABLES and MINERALS for a Phyſical uſe: by* Edw. Bolneſt *Med. Reg. Ord.* London, 1672. *in* 12°.

THis Author, having ſome years ſince in his *Medicina Inſtaurata* given a brief accompt of the Excellency of well-prepared Chymical Medicines, with the reaſons why they were and ought to be eſteemed ſuch; did then promiſe this Piece, wherein he undertakes to teach the *Manner* of their Preparation, by which he eſteems they are made moſt efficacious, ſafe and pleaſant Medicines for the preſervation and reſtauration of the Life of man. In the doing of which, he giveth *both* general inſtructions, *and* particular Examples in each kind, and of each Kingdome, as they ſpeak; which though not many, yet are by him conceived as ſufficient guides to a larger progreſs.

He begins with the general way of preparing *Animals* into a true medicine; and then deſcending to the preparation of a particular Animal, he would have Students of Chymiſtry conſider, what vertues Phyſitians have adſcribed to it, together with its doſe according to occaſion, and the ſtrength, age, and conſtitution of the Patient, and a fit vehicle. It were to be wiſhed, that ſince this Author often ſpeaketh of the *Fixed* Salt drawn from Animals, he had obliged the curious Reader with ſpecifying, what quantity of ſuch Salt he had by his own Operations obtained from Animals.

He proceeds next to the manner of preparing *Vegetables,* obſerving, that in them lies hid a very ſubtil and pure æthereal, and a fixed ſubſtance, the cheriſher and ſupporter of life, the food and nouriſhment of natural heat, the root and foundation of all its faculties: which ſubſtances whilſt they are abounding, trees flouriſh and bring forth fruit; but once decaying, they grow unfruitful, wither and dye.

Laſtly, he teacheth his way of preparing *Metals* and *Minerals* for the health of man, aſſuring the ingenious Searcher after this knowledg, that he may with confidence have recourſe to it, both for ſafety and efficacy, beyond the common Preparations now in uſe; and adding withall, that, becauſe he knows many Practitioners may want either time or conveniency to provide themſelves with ſuch Medicines, he promiſes herewith, that he will, upon their deſire, ſpare them ſuch Medicines as he hath prepared for his own uſe, *whether* of the more common preparations but better elaborated, *or* other particular remedies; and that, upon a friendly account, the Medicine rightly conſidered: Declaring moreover his willingneſs to afford any Learned Phyſitian the ſatisfaction of ſeeing his Laboratory, or the Preparation of any medicine he ſhall deſire at ſeaſonable times.

Here, when he treateth of the Preparation of *Mercury*, he intimates, that that being well perform'd it will yeild a Medicine much availeable in the cure of very many diſeaſes, and that *citò, tutò, & jucundè*; whereas otherwiſe, if *Mercury* be only changed in form, it may, being imprudently and raſhly uſed, do more hurt than good. Whereupon he ſets down ſome of ſuch Proceſſes and preparations of this odd Metal, as he judgeth moſt ſafe, and fit for internal Medicines: Which ſeem to deſerve the conſideration of ſober and intelligent Readers.

IV. *Miſcellanea Curioſa PHYSICO-MEDICA Academiæ Naturæ Curioſorum*: *annus* ſecundus, *anni ſc.* 1671. Jenæ 1671. *in* 4°.

As there was given an Account in N°. 68. of the firſt Years Philoſophical *Ephemerides* of the German Academy of the Curious Inquirers into Nature; ſo we ſhall here give notice, that the ſame Academiſts have made publick their Collections of the *ſecond* year, falling into 1671; In which amongſt many other particulars there are contained theſe following;

1. A diſſection of a Lyoneſs, and a Tyger.
2. Several odd peculiarities of Nature.

3. A ſingular Caſe of a German Counteſs, alwaies voiding *aquam-puerperii* fifteen daies before ſhe brings forth a Son, but not when a Daughter.

4. An odd generation of worms in the Eye-lids, and the cavities of the Ears.

5. A diſſection of an Infant deſtitute of all Brain.

6. A Preparation of Volatile Salt of Tartar.

7. *Napellus* not poyſonous in Poland.

8. A diſſection of a Mole and an Hedge-*Hog*.

9. A Belly altogether grown ſcirrous.

10. A diſſection of an Epileptical young man, and the Obſervables found in his Head, and the other parts of his body.

11. An uncommon Hiſtory of Stones taken out of the feet of Podagrical perſons.

12. Of a Woman having three Breaſts.

13. Reſpiration conſidered Mathematically.

14. A Perluſtration of the chief Mines in *Bohemia*, eſpecially of *Cuttenberg*, *Joachimſ-daal*, the *Beauteous Mary*, *Slackenwald* and *Schonfeld*: In which there are, reſpectively, Mines, of Silver mixt with Copper; a conſiderable Silver-mine called the Mine of *New Hope*, newly diſcovered: Mines of Bel-metal; of Biſmuth; of meer Silver; *&c.* together with divers conſiderable Obſervations of the ſite, conſtitution, and external productions of thoſe and their neighbouring places; as alſo of a notable ſubſtance, call'd *ſaxi Medulla*; of an highly valued Black Earth; of abundance of Granats growing there; of a whole Tree petryfied; of very pernicious damps; of pretended ſub-terraneous Dæmons; *&c.*

15. Another preparation of Volatil Salt of Tartar.

16. A wound of the Eye ſtrangely cured.

17. Inſtances of the ſtrange force of Imagination.

18. An odd Antipathy to Bread.

16. An Example of an Anniverſary Melancholy.

20. A verminous Tertian Ague.

21. Some Anatomical Obſervations upon Animals.

22. A diſſection of a Woman that had voided unuſual things.

23. Divers Experiments about Congelation.
24. An Hermaphroditical conception.
25. A ſtrang Birth of a putrified Embrio.
26. A very odd kind of Convulſions.
27. An admirable cure of a very grievous wound in the Head, with the loſs of part of the Brain.
28. A diſſection of a man that died of a Conſumption,and of another, that died of the Stone.
26. A *Caſtor* diſſected, *&c.*

For the reſt we muſt refer to the Book it ſelf, (to be met with at Mr. *Martyns* in St. Pauls Church-yard ;) after we have only intimated, that theſe Obſervations amount to 260 ; whereof many are illuſtratetd with elegant Cuts.

Errata.

There was a miſtake left uncorrected in N°. 81. p. 4021. l. 17 where, inſtead of iræ, *is to be read,* libidinis.

In N°. 82. *p.* 4036. *l.* 27. *r.* diſtitit 21′. 50′. *p.* 4037. *l.* 23. *r. alto* ♃ 29°, 35′.

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Numb. 85.

PHILOSOPHICAL TRANSACTIONS.

Auguſt 19. 1672.

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An Extract of a Letter of M. Hugens *to the Author of the* Journal des Scavans *of* July 25. 1672. *attempting to render the Cauſe of that odd Phænomenon of the Quickſilvers remaining ſuſpended far above the uſual height in the Torricellian Experiment.*

THE Experiment is briefly this; That a Tube, being, after the *Torricellian* way, filled with Mercury, and before inverſion perfectly purged of Air, doth, when inverted, remain top full, even to the height of 75 inches.

M. *Hugens*, to render a probable cauſe of this ſtrange effect, conceiveth, That, beſides the preſſure of the Air, which keeps the Mercury ſuſpended at the height of about 27 inches, and of the truth of which we are convinced by a great number of other effects that we ſee; there is yet another preſſure, ſtronger than that, of a more ſubtile matter than Air, which without difficulty penetrates glaſs, water, quickſilver, and all other bodies, which we find impenetrable to Air. This preſſure, *he ſaith*, being added to that of the Air, is capable to ſuſtain the 75 inches of Mercury, and poſſibly more, as long as it works only againſt the lower ſurface, or againſt that of the Mercury, in which ſtands the open end of the tube: But as ſoon as it can work alſo on the other ſide, (which happens when ſtriking or hitting againſt the tube, or intromitting into it a ſmall bubble of Air, you give way to this matter to begin to act) the preſſure of it becoms equal on both ſides, ſo that there is no more but the preſſure of the Air, which ſuſtains the Mercury at the ordinary height of 27 inches.

If you ask, why the Quickſilver in the Tube of this Experiment does not feel the preſſure of this matter, even whilſt that veſſel is yet full; ſince M. *Hugens* ſuppoſeth, that it pierceth without difficulty the Glaſs as well as the Mercury, &c? And why the particles of this matter do not joyn together and begin the preſſure, in regard that they go and come thorow the whole extent of the Mercury, and that the Glaſs does not hinder their communication with thoſe that are without:

To remove this difficulty, which in M. *Hugen's* own opinion is very great, he anſwers, That though the parts of the matter, by him ſuppoſed, do find paſſage between thoſe that compoſe the glaſs, quickſilver, &c; yet they there find not ſufficiently large ones for many to paſs together, nor to move there with that force which is requiſite to ſeparate the parts of the quickſilver, that have ſome connexion together. And this very ſame connexion, *he ſaith*, is the cauſe, that though on the ſide of the inner ſurface of the glaſs, which touches the ſuſpended Mercury, many of its parts be preſſed by the particles of this matter; yet there being alſo a great number of them, that feel no preſſure by reaſon of the parts of the glaſs, behind which they are placed; they retain one another, and they remain all ſuſpended, becauſe there is much leſs preſſure on the ſurface of the quickſilver that is contiguous to the glaſs, than upon that below, which is all expoſed to the action of that matter which makes this ſecond preſſure.

The ingenious and candid Author of this ſolution acknowledges himſelf, that it doth not ſo fully ſatisfie him as not to leave ſome ſcruple behind; but then he adds, that that keeps him not from being very well aſſured of that new preſſure, which he hath ſuppoſed beſides that of the Air, by reaſon as well of the Experiment already alledged, as of two others, which he ſubjoins to this effect;

Firſt, When two plates of mettal or marble, whoſe ſurfaces are perfectly plain, are put one upon another, they do ſo ſtick together, that the uppermoſt being lifted up, the undermoſt follows without quitting it: And the cauſe hereof is juſtly adſcribed to the preſſure of the Air againſt their two external ſurfaces. He taking then two plates, each of them but about an inch ſquare, being of that matter, of which anciently they made Looking-glaſſes, and cloſing ſo exactly together, that without putting any thing between, the uppermoſt keeps not only up the other, but ſometimes alſo with it three pounds of lead faſten'd to the lowermoſt, and thus they remain together as long as you pleaſe. Having thus joyned them and charged them with three pounds weight, he ſuſpended them in the Recipient of his Engin, and exhauſted it of Air ſo far as that there remained not enough to ſuſtain by its preſſure as much as an inch high of water; and yet his plates disjoyned not. He adds, that he made the ſame Experiment by putting Spirit of Wine between the two plates; and found, that in the Recipient evacuated of Air they ſuſtain'd, without being ſever'd, the ſame weight they did when it was full of Air. This, he thinks, ſhews clearly enough, that there remains yet in the Recipient a preſſure great enough after that of the Air is thence taken away; and that there is no more reaſon to doubt of it, than of the preſſure of the Air it ſelf.

The *Second* Experiment is, That whereas the effect of a ſiphon of unequal legs, by which you make the water of a veſſel to run over, is no longer adſcribed to a *fuga vacui*, but to the weight of the Air, which preſſing upon the water of the veſſel makes it riſe in the ſiphon, whilſt on the other ſide it deſcends by its weight ; M. *Hugens* found a means to make the water of the ſiphon run, after that the Recipient was exhauſted of Air, and he ſaw, that with Water purged of Air * it did the effect as well as without the Recipient. The ſhorteſt of the legs of the ſiphon was eight inches long, and its aperture, of two lines. And he will not have us doubt, whether the Recipient was well exhauſted of Air ; for he did aſſure himſelf of that, as well by finding that there came out no more Air through the pump, as by other more certain marques.

* *M.* Hugens *hath made the Experiment, the Cauſe of which is here conſidered, as well with* Water *as with* Mercury.

And this he takes for a further confirmation of his ſuppoſition of a preſſing matter more ſubtile than the Air. To which he adds, that, if you take the pains of ſearching, to what degree the force of this preſſure reacheth, (which he ſaith cannot be better made than by purſuing the Experiment with Tubes full of Mercury yet longer than thoſe employ'd by M. *Boyle*,) it will perhaps be found, that this force is great enough to cauſe the *Union* of the parts of Glaſs and of other ſorts of bodies, which hold too well together as not to be conjoyned but by their contiguity and reſt, as M. *Des-Cartes* would have it.

An Extract of Mr. John Templers *Letter of March* 30. 1672. *to Dr.* Walter Needham *concerning the Structure of the Lungs.*

IN Anſwer to the requeſt of an Ingenious Dr. of Phyſick I was lately engaged to give my thoughts of the Structure of the Lungs; which was as follows.

I have formerly fancied, the Lungs to be compoſed of a multitude of veſicles: Into which opinion I was perſuaded by inflation into the *Aſpera arteria* of Fowls; and obſerving the continuation of many veſicles extended from the *bronchiæ* thorough the *abdomen* to the *anus*, (which I conceive to be the cauſe of the conſtant motion of the *anus* in fowls; the Air having ingreſs and egreſs there; and alſo that to be the reaſon why the *anus*'s of fowls are in malignant diſtempers applied to draw the infection out of the body*:) I thence conjectured, the ſubſtance of the Lungs to be a Complication of a multitude of veſicles with the ſanguineous veſſels. And in this opinion I thought my ſelf confirmed by blowing into the *Aſpera arteria* of Quadrupeds, when I had cut off part of the exterior membrane of one lobe of the Lungs, and found the Lungs to riſe with unequal protuberances not unlike bladders.

* *Thoſe* anus's *being like Cups or* Ventouſes, *and the fowl having often ſtuck by its* anus *till it died; in which caſe the Author of this Letter affirms to have known ſeven chickens applied to the groin of one viſited by the plague, that ſtuck till they died, and the eight went quickly off, and lived above* $1\frac{1}{2}$ *year after.*

But this ſecond contrivance, which I am going to deſcribe to you, hath much ſhaken that conjecture.

March 2. 16$\frac{71}{72}$, I made a ligature about a Dogs neck, and opening both the Jugular veins with a pretty large orifice, I let him bleed to death, (uſing this way to prevent being overcharged either with any quantity of bloud or with bloud coagulated; both which would have been hazarded, in caſe I had either ſtrangled the dog, or cut one or both of the Jugulars aſunder:) Immediately I open'd the *thorax*, and tying the *vena cava*, with all the paſſages from the left ventricle of the Heart, or its *auricula*, I cut the Lungs with the Heart and *Aſpera arteria* entirely out. To the *Aſpera arteria* I fitted a *ſyphon*, long ſeven inches; which I thruſt two inches in length into the ſaid artery, and faſtned it with a ſtrong binding of pack-thred. This done, I blew up the Lungs, and fitting a cork to the end of the ſyphon, I hung them in a chimney to dry. In a quarter of an hour they ſubſided about a ſixth part; whereupon I order'd a perſon to watch them, and to blow them up as oft as they ſubſided. Which courſe continued, they would not the next morning ſubſide a fourth part in three hours. And (excepting three quarters of an inch diſtance from the circumference of the lobes, where the thinneſs of the ſubſtance of the Lungs gave the external heat the advantage of a ſudden paſſage, and quick diſpatch of drying thoſe parts leaſt furniſh't with moiſture,) I did not perceive, making a proportionable allowance for the drying of the whole ſubſtance of the Lungs, any conſiderable ſubſiding in two days more. But upon the blowing in at the ſyphon (whoſe ligature I was now forced to renew,) I could eaſily feel the Air to paſs through the external membranes, both on the convex and concave ſides, towards the extremity of the circumference of the lobes; but moſt abundantly on the concave ſide.

March 5th, I carefully cut off one of the lobes, and the inward ſtructure ſeemed like a cane or dried flag when tranſverſly cut; and, upon blowing in at the ſyphon, I fancied the Air to come equally out at all the pores I had expoſed to view. Whereupon I fixed ſpittle in ſeveral places, and upon freſh blowing found multitudes of bubles, made in the denudated parts of the lobe. Immediately I made a deep tranſverſe inciſion into that lobe, and blowing in at the ſyphon, I found the Air to come ſo freely out at the larger ramifications of the *bronchiæ*, that I could not give the lobe a conſiderable riſe with a ſtrong blaſt: Yet upon ſtopping with my fingers the larger paſſages of the *bronchiæ*, which I had cut, I found that lobe, upon a freſh blaſt, conſiderably to ariſe with unequal protuberances (where the inciſion was made,) giving no ſmall ſuſpicion of ſome latent veſicles. Hereupon I tyed that lobe above the inciſion, and taking off part of the external membrane of another lobe, (having firſt tyed up all the reſt of the lobes,) I poured water into the ſyphon, and applied a ſtrong blaſt, in hopes to have the water come forth in ſtreams at all the pores; but that did not ſatisfactorily ſucceed, it coming out in a confuſed irroration of the external ſurface, without any ebullition, unleſs at the larger ramification of the *bronchiæ*. Then I tyed up this ſecond lobe, and untyed a third, powring in an ounce of the oyl of turpentine; at the ſyphon I gave a ſmall blaſt, and corked it up. Two hours after I took off the ſmall membrane of that lobe, and upon a gentle blaſt at the ſyphon found an ebullition of infinite little bubles.

March 10*th* (having continued it to the chimney,) I cut all the lobes in pieces by different and various irregular inciſions; whence I could eaſily obſerve the ſeveral ramifications of the aerial and ſanguineous veſſels, with their continuation to the circumference of the lobes, and a proportionable diminution as they were at a further diſtance from their original.

Shall I hence conclude the Structure of the Lungs to be a Complication of a multitude of the Ramifications of the bronchiæ and ſanguineous veſſels? And that the ſeeming veſicles were occaſion'd only by the violence of the blaſt, and the drineſs of the extreme and ſmalleſt paſſages of the Aerial veſſels; whereupon thoſe,neareſt to the *bronchiæ*(being moiſter,) were, more than their ordinary proportion, extended, upon hindrance of a free and uſual paſſage to the Air in the leſſer veſſels or their extremities?

Theſe caſes I leave, with the manner of the Air's being commixt with the blood in the Lungs (which I think no hard matter plainly to diſcover,) to the *Virtuoſi* of our Age, who have infinitely more advantages for the diſcovery of Nature's works, and to whom I cannot imagine this ſcrible to be any novelty. In which uncertainty I leave it to your diſcretion to do with it as you pleaſe.

Some Aſtronomical Obſervations in part already made; partly to be made.

1. Lunæ ad Pleiadas Appulſus A. 1672. *Februar.* 23. ſt. v. Obſervatus *Derbiæ* Anglorum à *Johanne Flamſtedio.*

A*Ltâ Lunâ* 20°. 50'. *cepi ipſius Diametrum* 32'. 48"; *& altâ ipſâ* 19°. 23'. *rurſus eam cepi,* 32'. 47". *Ergo Luna in Horizonte Semi-diameter erat vera* 16'. 19". *Plus tamen etiamnum ab Occidentali ſtella Pleiadum abfuit quàm commodè caperet Teleſcopium. At* ——

H. 11. $19'\frac{1}{2}$ *p. m. altâ* ✱ b, *occidentali Pleiadum* 9°. 50'; *ejuſdem ſtellæ diſtantiam cepi à cornu Lunæ proximo* 11'. 58". *divertens deinde ſubitò ad* $\ast^{z}$ *altitudinem (oſtenſam quadrante ,* 20 *digitorum radio , ad Tubi latus affixo,) notandam, & continuò reverſus, ſtellam (quippe tunc à Luna tectam,) non comperi. Interea Luna deſcenderat minuta* 10, *ſimulq; tantundem Stella, quam ſubjiſſe Lunam h.* 11. $20'\frac{1}{2}$ *ex ſequente phaſi conjicio : Etenim*

H. 11. $30'\frac{1}{4}$, *altâ* $\ast^{z}$ e 8°. 43', *Stellam* c *à Luna tectam conſpexi: Ejus cùm cepiſſem à cornu proximo diſtantiam* 16'. 35", *ſpatium temporis inter hujus & præcedentis occultationem , editis ſupputationibus conſtitui* 9'. 37"; *quæ tempori hujus phaſeos ſublata, dant utique præcedentis Occultationis tempus ut conſtitui.*

H. 11. $37'\frac{1}{2}$, *altâ* $\ast^{z}$ c 11°. $37'\frac{1}{2}$, *ipſa Lunam ſubiit, me interea diſtantiam ejus dimetiente* 22'. 36". *à cornu Lunæ apparenter inferiori, ſed ſuperiori verè. Deinde protinus vicinum ponè tectum Luna deſcendens , amplius hac vice nequiit à me obſervari. Erat , ſtellâ evaneſcente , Lunæ ſemidiameter apparens* 16'. 21". *quæ propterea occultata erat* 87°. 25'. *peripheriæ lunaris à cuſpide ſuperiori, cujus erat reclinatio (à linea per Centrum ejus , Eclipticæ ducta perpendiculari)* 1°—37'. *Sic ſubingreſſus ſtellæ fuit* 4°. 12'. *ſupra lineam per Centrum Lunæ Eclipticæ ductam parallelam , & Lunæ centrum in antecedentia* $\ast^{z}$ 16'—18". *cum minori latitudine* 1°—12'.

Fixæ locus Authori Carolino ♉ 25°. 1'. 24"; *latitudo perpetua* 4°. 20'. 39". *quamobrem Lunæ locus apparens horâ apparenti* Derbiæ 11 *h*— $37'\frac{1}{2}$. *p. m. erat* ♉ 24°. 45'. 6". *& latitudo viſa* 4°—19'. 27". *Bor. Maturiores, ſemihorâ fere, apparentias ſupputationes noſtræ tabulis* Carolinis *promiſerant , quarum ut certum à cælis diſſenſum conſequar , Lunæ locum ad hanc ultimam phaſin ab iis eruo , nec non à Tabulis*

Bullialdi *Philolaicis, quas parum melius cœlos aſſecutas comperio.* *Etenim Hora apparens* Derbiæ 11^{h}. — 37'. 30''. *media erat Anthori* Carolino 11^{h}. 34'. 51''; *ſed* Londini 11^{h}—39'. 51''. Bullialdo *tempus eſſet medium* Derbiæ 11^{h}—46'. Uraniburgi 12^{h}—41'. *unde motus ab illorum tabulis hi colliguntur*;

	Bullialdo.				Streetio.			
	s	°	'	''	s	°	'	''
Solis Anomalia media	8	6	45	29	8	6.	34	15
Locus verus	♓.	15	21	52	♓.	15	17.	21
Lunæ Anomalia media	5	21	36	13	5.	21.	38.	41
Diſtantia à ⊙ 1° *æquata*	2	9	40	29	2.	9	38.	15
Locus in Ecliptica	♉.	25	54.		♉.	25	47.	48
Latitudo vera borea		4	59½		.	4	59	42.

	°	'	''
Recta aſcenſio ſolis.	346.	28.	
Temporis	174.	22.	
Medii cœli	160.	50.	
Medium cœli	♍ 9.	15.	
Ejuſdem declinatio	8.	6.	
Altitudo	45.	9.	
Horoſcopus	♏18.	43.	
Diſtantia medii Cœli ab Horoſcopo	69.	28.	
Angulus occidens	49.	12.	
☽^{x} *diſtantia, ſecundùm Eclipticam, Eclipticalis ab horoſcopo*	7.	6.	
In magno circulo	8.	40.	
Altitudine		63.	10''.
Parallaxis Lunæ in longitudine		47.	29.
Latitudine		41.	16.
Ergo Luna viſa	♉.25.	0.	0.
Cum latitudine Boreali	4.	18.	26.

Tabulæ propterea Carolinæ *cœlos exſuperant longitudine* 14′—53″, *à quibus latitudine deficiunt* 1′—1″. *Etiamſi in Eclipſi nupera* (Sept. $\frac{8}{18}$) *cum iis quàm proximè conveniebant. Locus fixæ Philolaicus* ♉ 25°. 4′; *Propterea tres tantum ſcrupulos minus quam* Carolinæ, Bullialdi *deviant tabulæ; quæ in eodem lunari deliquio* 20′. 51″ *temporis cœlos anticipabant.*

Notatu præterea digniſſimum, quòd, etiamſi omnes ferè omnium Aſtronomorum hypotheſes, Lunæ plenæ Perigeæ in quadraturis majorem tribuant diametrum, & proinde minorem à terra diſtantiam quam in ſyzygiis aut Oppoſitionibus Perigeis; Contrarium tamen cœlitus fieri & evenire: Luna etenim plena Perigea tranſiens juxta Pleiadas Nov. 6. 1671. *majorem habebat diametrum quàm in hoc tranſitu, quando in eodem ferè loco à Sole diſtitit gradus* 70 *Lunæ ſemidiameter horizontalis.*

Nov. 6. 1671. Bullialdo.	17′. 00″	Streetio 16 30	*Obſervata* 17. 00
Febr. 23. 1672. Bullialdo.	17—50	17. 13	16—19
	+ 50	+ 43	—41

Amplius non nunc miramur, Lunam tam diu numerorum recuſaſſe vinculos, & de tabulis ſupputata apparentiarum tempora uſque adeò expectationes noſtras fefelliſſe; à falſis quandoquidem hypotheſibus ipſas plerumque conſtructas fuiſſe liquet. At ubi nunc quærenda Luna? Verſatilis planeta noſter abiit, exceſſit; Et nulli numeri ductores, nullæ tabulæ, quæ non à ſuo cœleſti tramite nos deducant. Morandum pauliſper, donec accuratiſſimæ diametrorum obſervationes, commodiſſimis orbitæ locis habitæ, qualibus cieatur motibus, & quibus tandem legibus ij motus ſint obnoxii, aut quibus inveſtigandi & coercendi numeris, oſtenderint.

2. Jovis ad Fixam ♌'38. Regreſſus, *Derbiæ* Anglorum obſervatus, *Maii* diebus 24. 26, 27, 28, & 30. ſt. v. A. 1672. à *Joh. Flamſtedio.*

Die ♀, Maii 24, alto ♃ 24°—10′. hor. 10. 00′. humilior erat ejus centrum quàm ſtella, 7′—46″; à qua ſemel ejus cepi diſtantiam 20′. 0″. & deinde 19′. 54″. in antecedentia Fixæ ſtabat.

Die ☉. 26. has habui, nec inaccuratas, Cœlo ſereno.

	° ′	h. ′		′ ″	
Alto ♃	33—30	=8—46	*diſtantia centri* ♃^{s} *à fixa*	10–04.	*
	31—50	=9—00	*fixa altior erat quàm* ♃	6–30	
	29—10	=9—20	*altitudinum differentia erat*	6–38	*
	27—20	=9—33	*differ. Azymuthorum* ♃^{s} *& Fixæ*	7–19	
	27—00	=9—36	*diſtantia* ♃^{s} *à fixa denuò capta*	10–02	

Die ☽. 27. ventis interdum tubum moventibus, obſervabam

	° ′	h. ′		′ ″	
Alto ♃	31–24	=8–59	*centri à fixa diſtantiam*	6–02	*
	30–30	=9– 7	*Azymuthorum differentiam*	1–50	
	29–13	=9–16	*eandem rurſus differentiam*	1–52	*
	28–10	=9–23	*centri* ♃^{s} *à fixa diſtantiam*	6–01	

Die ♂. 28. ventis validè flantibus & Teleſcopium concutientibus notavi.

	° ′	h. ′		′ ″	
Alto ♃	31— 8	=8–57	*à fixa diſtantiam centri* ♃^{s}	6–02	*
	28–10	=9–19	*differentiam Azymuthorum centri, &c.*	3–29	
	26–30	=9–31	*iſthanc differentiam rurſus*	3–32	
	26–08	=9–34	*diſtantiam rurſùs*	6–07	

Die ♃. 30. alto ♃ 26°—15′. hor. 9–36′. Cœlo ſatis ſereno & quieto, Jovis diſtantiam à fixa cepi 15′–38″. Hac & præcedente nocte in conſequentia fixæ erat, antea ſemper in antecedentia.

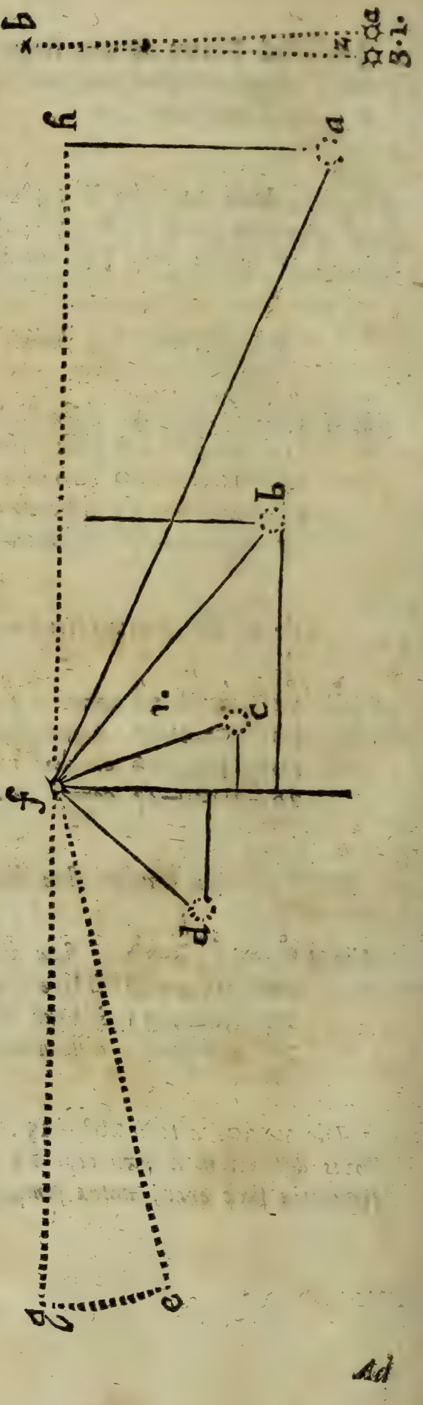
Harum observationum certissimas habeo, quas asterisco (✱) notavi. Azymuthorum differentias, diebus 27 & 28 observatas, nimis strictas acceptas æstimo, ob vacillationem tubi, quampropter, quando non ut volui eas accuratè dimetiri licebat, ne nimis amplas caperem curabam.

Vid. *Fig.* i. in qua

	Maii.	*h.*	′
a *Locus* ♃ˢ,	24.	10.	0.
b	26.	9.	0.
c	27.	9.	7.
d	28.	9.	19.

f . *fixa* ♌ 38. *lucis quartæ.*

g . h . *Almicantarah.*



Ad Jovis locum ab his obſervationibus obtinendum angulos ſupputavi parallacticos

	dies. h. ′	dies h.	dies h.
ſive circuli verticalis cum Ecliptica — } *Maii* —	26. 9. 00.	27 . 9–07	28. 9–19
	80°=47′ . .	79°=49′ . .	78°. 36′.
♃ˢ *à fixa diſtantia obſervata*	. . . 10—04″	. . . . 6 . 02″	. . 6–03″
differentia obſ. alt. ——	. . . 6–30	*Azym.* 1–50	*Azym.* 3–30
Ergo angulus poſitionis ——	31–01 .	62 . 38 .	66 . 03 .
Et planeta in antecedentia fixæ	. . . 8 . 38	. . . 2 . 51	*conſ.* 2 . 27
cum minori latitud. Boreali —	. . . 5–11	. . . 5 . 19	. . 5 . 32

Fixæ latitudo Tychonica 1°–20′–30″– *Bor. Locus mihi* 9°–57′.30″; *at* Streetio 9°–54′.09″, *cui propterea locus* ♃ ;

Maii. h. ′	° ′ ″	*Ab epilogiſmo tabularū* Carolinarum	*Error* ′ ″	*Lat. obſerv.* ° ′ ″	*Lat. ſupputata* ° ′ ″	*Error* ′ ″
26 . . 9 . 00.	9–45–31	9–40–51	-4–41	1 . 15 . 19	1 : 16 . 39	+ 1.20
27 . . 9 . 07. *in* ♍	9–51–18	9–46–28	-4–50	1 . 15 . 11	1 : 16 . 28	+ 1.17
28 . . 9 . 19.	9–56–36	9–52–16	-4–20	1 . 14 . 58	1 . 16 . 17	+ 1.19

Quid amici de hoc phænomeno obſervârint, nondum audio, tametſi quotidie audire expecto. De tranſitu, Junii 30. *expectato, nihil obſervare potui ob nubes & pluvias, diebus illis præcedentibus & ſequentibus frequentiſſimas.*

3. Martis obſervatio ab eodem *J. Flamſtedio.*

ANno *eodem* 1672. Maii 14. *ſt. v. mane, Ibat* ♂ᵗⁱˢ *ſidus prope ſtellam, dictam,* Quæ ad Clunes Aquarii; *cujus latitudo* 2°. 0′. 0″. *locus tum mihi* 24°. 12′. 09″ ♒; Streetio, 24°–09′. 06″. *è qua notabam,*

Altâ fixâ verè 9° 40′. 2ʰ. 29′ *manè, Martis in eodem Azymutho præciſè diſtantiam* —————— } 24′–17″ *Vide* Fig. 2.

11°–12′. *eandem denuo diſtantiam* ———————— 24 . 24

12ʰ. 00. 2. 51′. *planeta diſceſſerat ab eodem Azymutho eratque ad ortum à linea : Azym. differentiâ* — } 0 . 55

Horâ

	°	'	"
Horâ 2. 29 *mane. Angulus parallacticus erat* ———	82.	26	
Ergo ♂ *in conſequentia fixæ* ———		3 .	11
cum majori latitudine Auſtrali ———		24 .	04
♂*tis* *propterea latitudo* ———	2 .	24 .	04
locus verus ——— Streetio ♒	24.	12 .	17
Mihi ♒	24.	15 .	40
At locus Martis è tabulis Carolinis *ſupputatus* ——— ♒	24.	17 .	22

Scil. juſto promotior 5'. 5". *latitudo vera,* 2°. 27'. 29". *major etiam obſervatâ.* 3'. 25".

4. Apographum Epiſtolæ à Dn. *Johanne Flamſtedio*, Aſtronomo Derbienſi, ad Editorem ſcriptæ, de Tranſitu Planetæ *Martis* ad tres Fixas in ♓, celebrando menſ. *Sept.* & *Octob.* 1672.

—MItto Tibi Schema Tranſitûs ♂*tis* *ad tres* Fixas *in* ♓, *ut fidem ea de re pronuper datam liberem. Rem ut potui deproperavi, ut quibus viſum Tibi fuerit prædictionem hanc impertiri, maturè ſe parent ad curatas ejuſmodi habendas Obſervationes, quales Phaſis hæc depoſcit.*

Locorum ♂*tis* *in Ephemeride ſubjectâ calculum inii ex Tabulis* Streetii *ad h.* 8. o'. *p. m.* Derbiæ, *&* *tempus æquale. Ea quæ ex* Heckero *tranſcripta ſunt, ad eundem reduxi. Accuratum ſubduxi calculum loci Planetæ ex Tabb.* Streetii, *ut diurnus ipſius motus inveniatur exactè, ad comparandum eum cum obſervatis motibus in dato ſpatio temporis, atque ad Parallaxes inveniendum; quanquam in ea ſim ſententia, quam bene fundatam putem,* Heckeri *Ephemerides vera loca* ♂*is* *longè propius oſtendere, quàm* Streetii *numerum.*

Derbiæ

1672. Derbiæ h.8.0′.0″. p.m.	♂^{is} *locus in* ♓. ° ′ ″	*Latitudo M. A.* ° ′ ″	*Diſt.* ♂^{is} *à Terra qual.* ⊙ 100000	Heckeri ♂ *in* ♓. ° ′	*Ephem. Lat. M.A.* ° ′	♂^{is} *Parallaxes* Street. ′ ″	Kepl. ′ ″	Wing. ′ ″
Sept. 15	13.11.13	4.50.11	41318	12.54	4.46	0.36	2.25	5.41
ſt. vet. 16	13. 1.26	4.45.26		12.45	4.42			
17	12.52.25	4.40.43		12.36	4.37			
18	12.44.10	4.36. 0	42296	12.28	4.33	0.35	2.22	5.32
19	12.36.41	4.31.10		12.22	4.28			
20	12.29.58	4.26.21		12.14	4.24			
21	12.24. 0	4.21.34	43385	12. 8	4.19	0.34	2.18	5.25
22	12.18.48	4.16.43		12. 4	4.14			
23	12.14.24	4.11.52		12. 0	4. 9			
24	12.10.46	4. 7. 0	44589	11.56	4. 4	0.33	2.14	5.16
25	12. 7.56	4. 2. 9		11.53	4. 0			
26	12. 5. 3	3.57.18		11.51	3.55			
27	12. 4.38	3.52.27	45895	11.50	3.50	0.32	2.11	5. 7
28	12. 4.12	3.47.38		11.50	3.45			
29	12. 4.34	3.42.50		11.50	3.40			
30	12. 5.43	3.38. 3	47302	11.51	3.36	0.32	2. 7	4.58
Oct. 1	12. 7.42	3.33.16		11.53	3.31			
2	12.10.29	3.28.30		11.56	3.26			
3	12.14. 4	3.23.46	48804	12. 0	3.21	0.31	2. 3	4.49

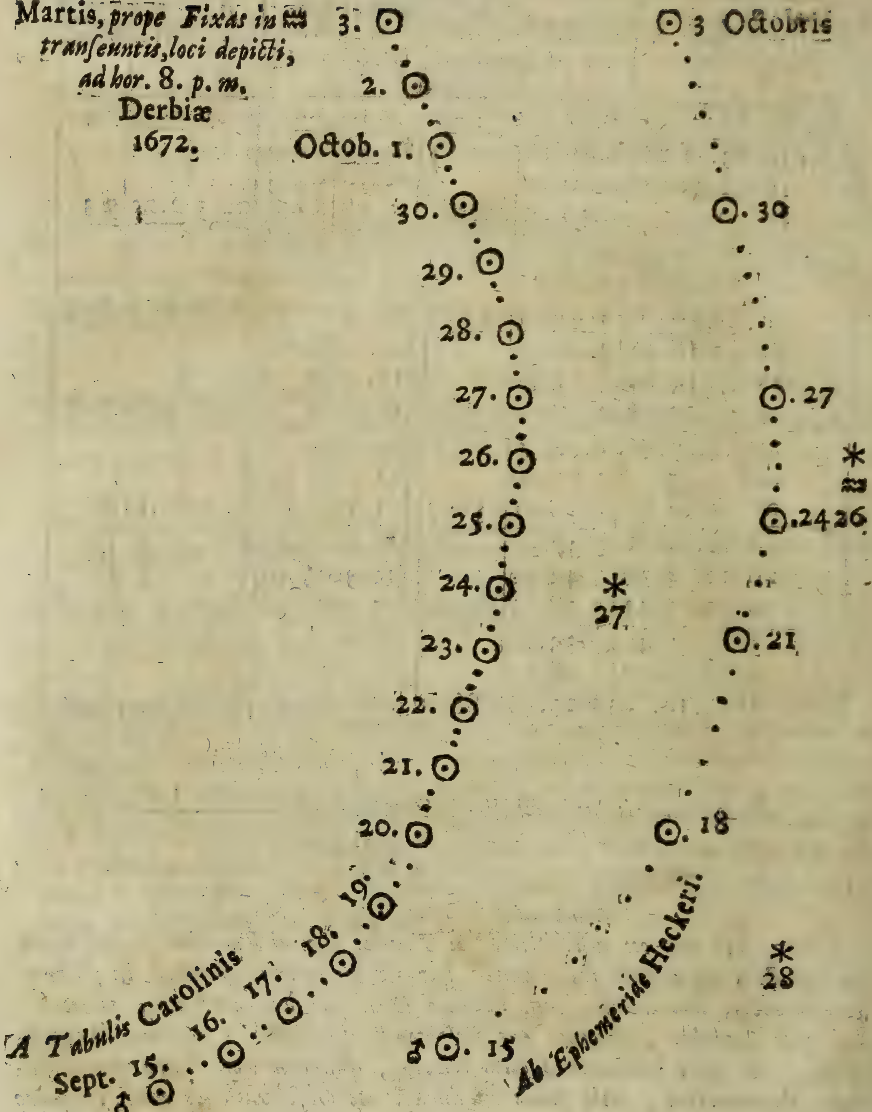
Solis parallaxis horizontalis eſt Streetio ———————— 0′. 15″.
———————————— Keplero ———————— 1. 0.
———————————— Wingio ———————— 2. 21.

Unde, nec non ex diſtantiis ♂^{is} *à Terra, inveni Parallaxes ejus prout in Tabula; quæ cum ſatis amplæ ſint & quantitate ſenſibili in inſtrumentis meis, non dubito, me, favente Deo, facilè inventurum, admittatne ipſas Cœlum. Minores eas exſpecto* Keplerianis; *majores* Streetianis. *At verò compertum cùm habeam, quantum conjecturæ meæ antehac aberraverint, volo planè ut ducant me Obſervationes meæ, torquere eas nolo.*

Rogo Obſervatores, ut nudas mihi Obſervationes ſuas communicent, notatis earum ritè habitarum temporibus; quibus meas adjicere non detrectabo, ſi iis inſtituendis Cœli annuerint. Vale.

Dab. Derbiæ *d.* 31.
Julii 1672.

Martis



Martis, *prope Fixas in* ♒ *tranſeuntis, loci depicti, ad hor.* 8. *p. m.* Derbiæ 1672.

	Streetio	Keplero	*Lat.*
	° ′ ″	° ′ ″	° ′ ″
♒. 26	11—40—22	11—44 : 0	3—58 : 0
✱. 27	12— 8—22	12—12— 0	4—10—30 *Auſt.*
28	12—11—52	12—15—30	4—44— 0
	♓	♓	

An

An accurate Deſcription of the Lake of Geneva, *not long ſince made by a perſon that had viſited it divers times in the pleaſanteſt ſeaſon of the year ; and communicated to the Publiſher by one of his Pariſian Correſpondents : Engliſh'd as followeth :*

YOU have reaſon, *Sir*, to demand of me an account of the *Lake of Geneva*, which, in my opinion, about this ſeaſon of the year (in *June*) is one of the moſt pleaſant places of the world. This is the third time I have viſited it, and I am, if I may ſay ſo, more charmed with it than the firſt.

I ſhall ſay nothing of the *Alpes*, nor of mount *Jura*, which do environ it, which by this Lake as by a large Ditch are ſeparated from one another : for that would not give you a ſufficiently fair *idea* of the Country. Be pleaſed therefore to repreſent unto your ſelf a Croiſſant of water, one extremity whereof is eighteen leagues diſtant from the other, and the banks of which are gently raiſed to ſome hights, then to collines, and at length to ſtupendious mountains ; which yet are not ſo linked to one another but that they leave betwixt them interſtices of fifteen or twenty leagues proſpects, checkered by medows, corn-fields, orchards, vines, Foreſts of Fir-trees, Snow lying on the ſides of the Rocks. All theſe objects, which at a diſtance are confounded, and ſeem to make but one, have near hand their ſeveral beauties : So well is the Country interſected by Rivolets, which, after they have ſerved to make Iron, Paper, &c ; run into the Lake, carrying with them very many fountains.

But leaving theſe things, I ſhall now content my ſelf to entertain your Curioſity by giving you a candid relation of what I have there obſerved in the ſpace of four months.

Although I have told you, that this Lake hath the figure of a *Croiſſant*, yet that point, where is *Geneva*, is ſomewhat longer and more extended than the other. This Croiſſant where 'tis largeſt, which is from *Morges* to *Thonon*, is about five good leagues over. That which hinders from making an exact eſtimate of its largeneſs in other places, is, that the Winds by driving the water toward the banks have made certain points, which advance far into the Lake, in ſuch ſort that when one happens to be oppoſite to the other, the Lake ſeems to be narrow : As may be obſerved in going from *Geneva* to *Nion*, where it ſeems as if the *Pharus* or Watch-tower of *Prangin*, which is in *Suiſſe*, did almoſt touch *Savoy* ; whereas yet one is a league diſtant from the other. And, what is remarquable, is, that at the coming out of this Straight, the Lake hath there almoſt its greateſt breadth and depth.

The water of this Lake is very good to drink, and ever ſo limpid, that even in the roling of the waves, which ſometimes go high enough, the water is not troubled but along the banks. And if one do attentively look down from the Caſtle of *Chilon* or from any of the neighbouring hights into in the bottom of the Lake, he may ſee high mountains

under

under the water. And the water is ſo deep before *Veuvay*, that the ſounding line at the end of four hundred fathoms ſeems,becauſe it will not ſtay,to touch upon ſomething ſlippery.'Tis held to be 500 fathoms deep before *Roole*; and 'tis affirmed, that near this great depth there may be ſeen a kind of *Iſle* under water.

The *Rhone* enters at one of the points of the Croiſſant into the Lake, and iſſueth out at the other; but with this difference, that whereas he comes in dirty and miry,he ever goes out ſo pure and clear,that under the bridge of *Geneva*, where the water is deep twenty five feet in ſummer,you may well diſcern the ſmalleſt ſtones at the bottom. And the ſame water,which in this place appears of a Saphyrin blew in the ſhade of the Houſes,appears altogether green, nor is ſo tranſparent,when the Sun ſhines on it.

There is a great diverſity of opinions as to the *Current* of the Rhone in the Lake; ſome maintaining, that *it* may be diſcerned,others denying it.Having heard the ſentiments of the Curious of *Lauſanne* and *Geneva*,and the opinions of the moſt knowing Fiſhermen that are there in great number, and eſpecially at *Coupet*, I believe with the latter; That,although the Rhone entring into the Lake looſeth its violence, yet doth he ſtill keep ſome ſenſible motion in ſome places, and every where obſervable,and that no Trouts are taken any where in this Lake but in this Current of the *Rhone*; which is what theſe Fiſhermen call, to go and fiſh *ſur le mont*.

Others there are,that go further and ſay,that one may every where diſtinguiſh the water of the Lake from that of the Rhone : But the Fiſhermen will not allow this, but aſſert, that there is no other mark than thoſe lately alledged, *viz.* of the Trouts, and the Current; and that the latter of theſe is alone ſufficient, in calm weather, to obſerve the Current of the Rhone from the place of his entring the Lake unto that of his going out.

The water of this Lake commonly begins to increaſe about the end of *January*,or the beginning of *February*,and continues to do ſo unto the twentieth of *July*,and often unto the very month of *Auguſt*; and then it inſenſibly decreaſeth, ſo that the water is leſs high in winter than ſummer by 12 or 15 feet; the froſts draining the Springs, or rather freezing the waters that iſſue out of them.

About this Increaſe of the water there are alſo different opinions. 'Tis true,they all believe in general,that the principal cauſe of the increaſe of the water is the melting of the Snow, and of the mountanous Ice,that is in the winter formed of the waters of the Springs and Torrents,which the froſt fixeth. This is ſo true, that when there is much ſnow in winter, the waters are very high the enſuing Summer. But when great Rains chance to fall in *January*,then the Snow, not yet being well hardned, melteth on a ſudden altogether. And when this melting is not ſo violent,all the Snow,that will melt, melts at the end of *May* or at the beginning of *June:* ſo that, there remaining but the ſtock of Ice for entertaining the increaſe of the water unto the month of *Auguſt*, ſome have thence been induced to ſay, that this increaſe, which amounts, as hath been ſaid, to 15. feet water generally all over the Lake, is cauſed by the herbs, growing, as they pretend, at its bottom in great abundance; and that theſe herbs whilſt growing, do force the water upwards, and dying in autumn make the water to ſink lower. Which is not ſatisfactory to me, becauſe there are no herbs ſeen upon the Lake, and very little within it, and the banks being very dry.

Others there are, that will have this water rarified by the heat of the Sun, and thereupon ſwelled on the borders, hot water not being ſo high in the middle as cold.

This is certain, that all the rivers and torrents, that fall into this Lake, carry with them ſtore of ſtones and earth, which may indeed enlarge and raiſe it: But ſuch an augmentation or riſe cannot be ſenſible but from age to age; not to mention, that in winter, whilſt the water is low, the ſtones of the Lake are carried away for building or fortifying at *Geneva*.

At the iſſuing out of the barres, that forme *Geneva*, on the ſide of the Lake, are ſeen in the water two or three huge Flints, ſtanding out of the water; the chief of which they call *Niton*: And the tradition is, that it formerly was an Altar conſecrated to *Neptune*; there being alſo a place cut out in the middle, which they take to have been the place for the ſacrifice. On this Flint ſeven or eight perſons can ſit; and ſometimes, when the waters are very low, there are found about it knives, and needles as thick as bodkins of tweeſes, and much longer; both of braſs, well enough made, and eſteemed to have ſerved for the ſacrifices.

This Lake in ſerene and calm weather appears ſometimes, and that even before Sun-riſing, as if it were made of divers pieces, differently coloured; part of it being browner than the reſt: which ſeems to be cauſed by a breath of wind paſſing thorow the water, coming either from the bottom of the Lake, or from above; though others think this gentle agitation to proceed from ſome ſprings that are at the bottom, making the water ſhiver above. But that part of the water, that is not moved, appears as even and ſmooth as a looking-glaſs, or like water traced by a ſhip. And as for the Colors, they are, in my opinion, an effect of the neighbouring mountains, the different images of which, being confounded in the water, make an appearance of very pale colours.

After that the Rhone is entred into the Lake, he retakes not his impetuous courſe before a quarter of a mile's diſtance from its coming forth again, that is, above *Geneva*. And the nearer he comes to that Town, the more his bed becoms narrow, and conſequently his courſe more rapid. Yet this rapidneſs hath been in our times once ſurmounted by wind, and once by water. To underſtand which, you may imagine,

gine, that in *Geneva* there is a ſtreak of Land about an hundred fathoms long, which divides the Rhone into two parts, paſſing under four bridges, then cover'd with houſes. From the point of this Iſle unto ſeveral ranks of ſtakes on that ſide of the Town there are about a thouſand common paces. This whole ſpace of water, which makes the figure of an V (whereof the Iſle is the point, and the Town formes the ſides ; and the ſtakes, the empty place of the end,) hath been once laid dry by a violent wind, after this manner. One day in the winter of the Year 1645. there aroſe in the morning about 9 a clock ſo furious a wind, that not only it uncovered the houſes, but alſo laid dry the bed of the Rhone above the bridges, ſo that many, in the view of all the town, croſſed quite over it dry-foot, and one of the ſons of M. *D'Aubigny* took up ſome medals, which he found in his way. This paſſage was free during an hours time ; at the end of which the Rivers retook its courſe. At that ſeaſon the water being very low, and a weſt-wind, to arrive at *Geneve*, being preſſed by the high mountains, that bring it upon the town as by the noſe of a pair of bellows ; it came to paſs, that that wind did violently bear upon the water near the ſaid bars, keeping ſuſpended the water that was beyond, and thoſe waters, that were beneath, running away downwards by a declivity, and under the ſhelter of the houſes. Whilſt I was ſcrupling at this relation, they brought me *Gallaſius* his Commentary upon *Exodus*, printed 1560 ; where 'tis recorded, that the like accident had faln out at *Geneva* at the time when that Miniſter lived there, a South-weſt-wind having made the Rhone to recoile into the Lake, and many people having thereupon paſſed over dry for an hours time.

Concerning the other accident ; you may remember, that the river *Arve*, which is a kind of Torrent, falls into the Rhone, about a 1000 paces beneath *Geneva*. In the month of *December* in the Year 2652. the ſaid *Arve* did ſo extraordinarily ſwell, that not only it over-run its banks with impetuoſity, but alſo interrupted the courſe of the Rhone, and forced it to re-enter into the Lake for the ſpace of fourteen hours ; though ſome do eſteem, that the *Arve* diſ-gorged it ſelf for that time into the Lake, by paſſing *over* the water of the Rhone, which, in their opinion, continued his courſe under the water of the *Arve*. However, the water was ſeen at *Geneva* to re-enter into the Lake.

But to conclude, this Lake doth very much abound in Fiſh ; but that which is obſervable is, that thoſe Fiſhes have as 'twere cantonized themſelves, and divided the Lake amongſt them. The *Trouts* are not to be found there, but, as hath been already mentioned, in the Current of the Rhone : the *Carps* have taken up their quarter towards *Veuvay* : the *Pikes* and *Pearches* have alſo their habitations apart. But ſome other fiſh, that are but paſſengers, not living conſtantly in the Lake, ſpread themſelves almoſt every where indifferently.

The great Trouts paſs out of the Lake for four months of the Summer,and are taken in autumn when they are returning thither. The Fiſhing is farmed out at *Geneva*; and there are Conſervatories where many of thoſe big Trouts are kept, among which there are ſome that weigh fifty pounds.Sometimes they catch Pikes there of eighty pounds weight; and a pound weight at *Geneva* you know to be eighteen ounces.

In the months of *July* and *Auguſt* they fiſh there for the Fry of Pearches, at a time when they are no bigger than the ſmalleſt taggs. Theſe are a very delicious diſh,there called *Mille Cantons*.

I ſhall add no more than put you in mind of that Duke of *Savoy*, who renounced his Crown and the Pontificat it ſelf to paſs deliciouſly the reſt of his dayes at *Ripailles*, where he made ſo good cheer to all that viſited him,that,to expreſs a very merry entertainment, they ſay ſtill, *faire Ripailles*.

An Accompt of ſome Books.

I. *LUX Mathematica,Colliſionibus* Johannis Walliſii *S.Th. D.* & Thomæ Hobbeſii *Malmesburienſis,excuſſa: Multis & fulgentiſſimis aucta radiis, Auth.*R.R. *Adjunctâ Cenſura Doctrinæ* Walliſianæ *de* Libra, *unà cum Roſeto* Hobbeſii. Londini,*pro* Guil.Crook *in vico vocato* without Temple-bar, 1672. *in* 4°.

THe Author of this Book dedicated to the *Royal Society*, having told the Reader in the *Preface*,that he hath deduced the riſe and occaſion of the Diſputes betwixt Dr.*Wallis* and Mr. *Hobbes*, and commended the many and difficult Propoſitions and Demonſtrations, ſaid to be advanced by the latter of them,and compared therewith thoſe of Dr.*Wallis*; having alſo ſubjoined in the ſame the things that by M. *Hobbes* are judged *manifeſt*: Proceeds in the Body of the book to the Controverſies themſelves; endeavouring to vindicate Mr. *Hobbes*'s Aſſertions from the Objections of Dr.*Wallis*, particularly thoſe, that were publiſhed in N°. 73. and 75. of theſe *Tranſactions*; which Monthly Papers,(to touch that by the by,) this Author, by a great miſtake, calls p. 36. the *Tranſactions of the R.Society*; whereas they are notoriouſly compoſed by a Single Perſon, who hath not only declared ſo much in ſeveral places of theſe *Tracts*, and moſt ſolemnly in N°. 12. p. 213, 214; but alſo adds his very name to them in the Dedications of every years volume.

The Controverſies, by the Author enumerated, are 13.

1. *De Rationum calculo per magnitudines Infinitas*
2. *De ſignificatu vocis* Rationis *apud Mathematicos.*
3. *De Ratione rectanguli ad Parabolam, ad Paraboloeides ſolidum, ad Parabolam Cubicalem, & ad alias Figuras ipſi inſcriptas.*
4. *Utrum* Numeri *quadrati radix eadem ſit cum* Figuræ *quadratæ latere.*
5. *De Puncto,de Longitudine ſine Latitudine; & an Angulus ſemi-circuli ſit rectus?*

6. *De Sectione lineæ rectæ extremâ & mediâ ratione.*
7. *De Polygonis regularibus.*
8. *De Æquatione lineæ Rectæ & Arcûs circuli.*
9. *De Tangente arcûs graduum* $22\frac{1}{2}$.
10. *De Prudentia ad ſtudium Geometriæ neceſſaria.*
11. *De latere Icoſaedri.*
12. *De Quadratura Circuli.*
13. *De natura Libræ.*

A Reply to theſe Animadverſions, being expected from the Perſon concerned, will probably be inſerted in the next following *Number*.

II. *OPTIQVE de PORTRAITVRE & PEINTVRE, contenant la Perſpective Speculative & Pratique accomplie,&c.Par* Gregoire Huret, *Deſſeignateur & Graveur Ordinaire de la Maiſon du Roy, & de l'Academie Royale de Peinture & Sculpture. A* Paris, 1670. *in Fol.*

THis Elegant volume in *French* declareth the chief aim of its Author in the compoſition thereof to have been, to contribute what he could to the inſtruction and improvement of youth, ſtudious of theſe excellent Arts,and groundedly to teach them the Rules and other means,that are really uſeful and abſolutely neceſſary to them in the ſame, ſo that they may both make uſe of them, and diſcern them from abundance of falſe and imperfect ones,that,he eſteems,have been delivered to them in moſt of the Treatiſes hitherto made about this ſubject.

In the performance of which, he divides this Volume into two parts : The *Firſt* contains the accompliſh't (for ſo he calls it) *Practical* Perſpective, to repreſent the ſumptuous Architectures of the moſt magnificent Buildings in Perſpective,by two wayes ; the *former* ſhewing the means to arrive to a compleat exactneſs, but ſuch as are only taught to inform the underſtanding, and not to be practiſed, if you will not : the *latter* containing the ſhorteſt and eaſieſt means of all that have been publiſh't hitherto ; and that for general practiſe, and all without uſing any point of diſtance nor Geometric plane.

The *Second* part diſcourſes of *Speculative* Perſpective ; *viz.* of the Demonſtrations and Explications of the Fundamental Secrets of the Rules or Means contained in the Firſt part ; together with the moſt Curious and moſt Conſiderable Queſtions, that have been hitherto propoſed upon this argument of Pourtraiture and Picture, with their Solutions.

About the end of this Book the Author annexes an Accompt and ſome Remarques of his, concerning the Deſign of M. *Deſargues's* Rough-draught of his Treatiſe of *Coniques*, entituled *Leſſons de Tenebres*.

We muſt not omit to take notice here, that in the Extract of the *Priviledge* given to this Book (pag. 159.) mention is made of two other

Books compoſed by this ſame Author ; entituled, 1. *La Gnomonique ſpeculative & pratique, contenant les regles pour faire les Quadrans Solaires Aſtronomiques, Babylonique, Italique, & Ancienne Judaique, & tous les cas qui leur ſont appliquez. 2. La Section des Solides, Speculative & Pratique, appliquée à l'Art de l'Architecture, pour les conſtructions preciſes des Traits de la Coupe des Pierres, ou Vouſſoires de toutes ſortes de Voutes, avec la declaration entiere des Secrets fondamentaux des-dits Traits.*

III. Chriſtiani Friderici *Garmanni, Phyſici Chemnicenſis, Academici Curioſi, HOMO EX OVO.* Chemnitii, 1672. *in* 4°.

THis Author having collected what of late years hath been by divers curious Anatomiſts aſſerted and publiſhed concerning the Generation of other Animals, as well as of Fowl and Fiſh, out of Eggs ; and taken with *Kerkringius* particular notice, *tam Virgines quàm Conjugatas ſæpiſſimè Ova excernere* (which he no more wonders at, than that Hens and other Birds are *matres & tamen virgines* ;) having, I ſay, done that, he proceeds to conſider the advantage of this Doctrine, and its happineſs in explicating many *phænomena*, hardly explicable without it ; ſuch as are, the Production of more *fœtûs* than one ; the production of Monſters ; the many odd Symptoms in Women, from the putrefaction or imperfect conſtitution of the Egg or Eggs ; the Production of Mola's ; Barrenneſs, &c.

Having diſpatched this, he takes occaſion to examine this Queſtion, *An fieri Conceptio poſſit extra Uterum?* Ubi nonnulla differuntur de Homunculo Chymico ſive Paracelſico ; quæ apud ipſum vide Authorem.

IV. *A ſhort and ſure Guide in the Practice of Raiſing and Ordering of FRUIT-TREES ; by* Francis Drope *B. D. late Fellow of Magdalen Colledge in* Oxford. *Printed at* Oxford, 1672.

THis piece appearing by the *Preface* to have been writ from the Authors own Experience, we thought good here to take notice of it, and to recommend it to the peruſal and examination of Ingenious and Induſtrious Planters, that they may compare with the already publiſh't writings of others upon this ſubject, and their own practice, the particulars inſiſted on in this Diſcourſe ; which are principally ;

1. Of raiſing Stocks from the Seed ; from which the beſt of Stocks, in the Authors opinion, are produced ; together with particular directions to the beſt kind of ground to ſow the reſpective ſeeds or ſtones in ; and what grafts take on what ſtocks.

2. Of the Nurſery or place where young Trees are to be brought up before the Tranſplantation into an Orchard. Here are cleared the difficulties about the choice of ground for the Nurſery, and about the due ordering thereof before Planting. Then, the Work it ſelf and the ſeaſon thereof conſidered. Further, the earlier and late removal examined. Laſtly, ſeveral circumſtances, to be obſerved in the Planting, recommended.

3. Of Grafting,and the ſeveral wayes thereof; together with the due Preparation and Time for it. Here the Author treats of Stock-or Cleft-grafting; of Whip-grafting, (otherwiſe called Packing or Splicing;) of Shot-grafting,like the ſhooting of two pieces of timber,as in a Ship-maſt, together ; of a Peculiar way of grafting, much uſed by ſome of the beſt Nurſery-men about *London*, here commended for its certainty and eaſie diſpatch ; of a ſingular way, tryed by the Author,and by him eſteemed the neareſt and leaſt dangerous and hurtful for the grafting of great Stocks. In this ſame *Chapter* is diſcourſed of *Inarchings*, to be uſed in Trees, whoſe Cions will not be grafted if taken clean from the Tree,whereon they grew at the firſt : Where the Reader is taught,how in a year or two ſtore of Aprecocks may be produced without Inoculation,by ſetting before-hand Plum-ſtocks round about an Aprecock-Tree at ſuch a diſtance,as that they may be grafted by theſe wayes of Inarching.

4. Certain Rules to be obſerved *in* and *after* Grafting; together with a cenſure of vulgar Grafters, that always pick off the ſide-buds, till ſuch time as the Tree is high enough : Adding alſo ſome advertiſements for the Choice of Grafts.

5. Of Inoculation,and the principal time for it ; together with directions,what ſort of Trees are firſt to be inoculated,which laſt, and which between both : As alſo,of the quickeſt and ſafeſt way of Inoculation ; and of the Authors opinion concerning that manner of Inoculation, which is made without taking away the wood from within the Eſcutcheons. To which are added inſtructions concerning the fitteſt Weather for inoculating ; and how to prevent miſchief by much heat,drought,and hard winter ; as likewiſe a mark whereby to know, whether the bud have taken or no. All which is concluded with an aſſignment of the Cauſe,why the greateſt part of Trees yield better and fairer fruit through Inſition,than when permitted to bear from Seed ? The determination of which is here attempted to be made by comparing Trees and Animals, and by the conſideration of the manner of Nutrition in the latter.

6. Of Stocks raiſed without Seed,and Trees without Inſition : concerning which the Author delivers ſome things concerning Stocks procured out of the Woods, and Suckers from the Roots of Trees, where Seedlings cannot be obtained. To which are added the ways of propagating Trees by *Layers* ; as alſo by Roots left in the ground.

Advertiſement.

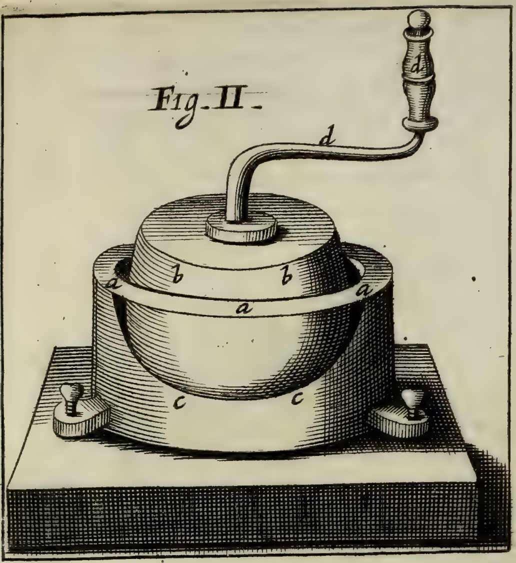
IT was thought fit,herewith to give the Reader notice, that the next of theſe Tracts will not come abroad till the end of *October* next.

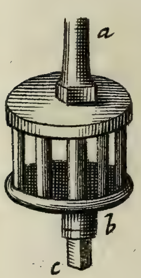
LONDON,Printed for *John Martyn*,printer to the *Royal-Scociety*,1672.

BRITISH MUSEUM NATURAL HISTORY.

Tab. I.

Fig. II.





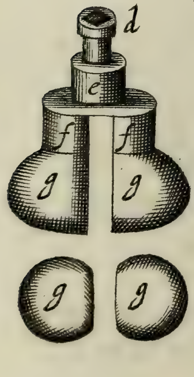
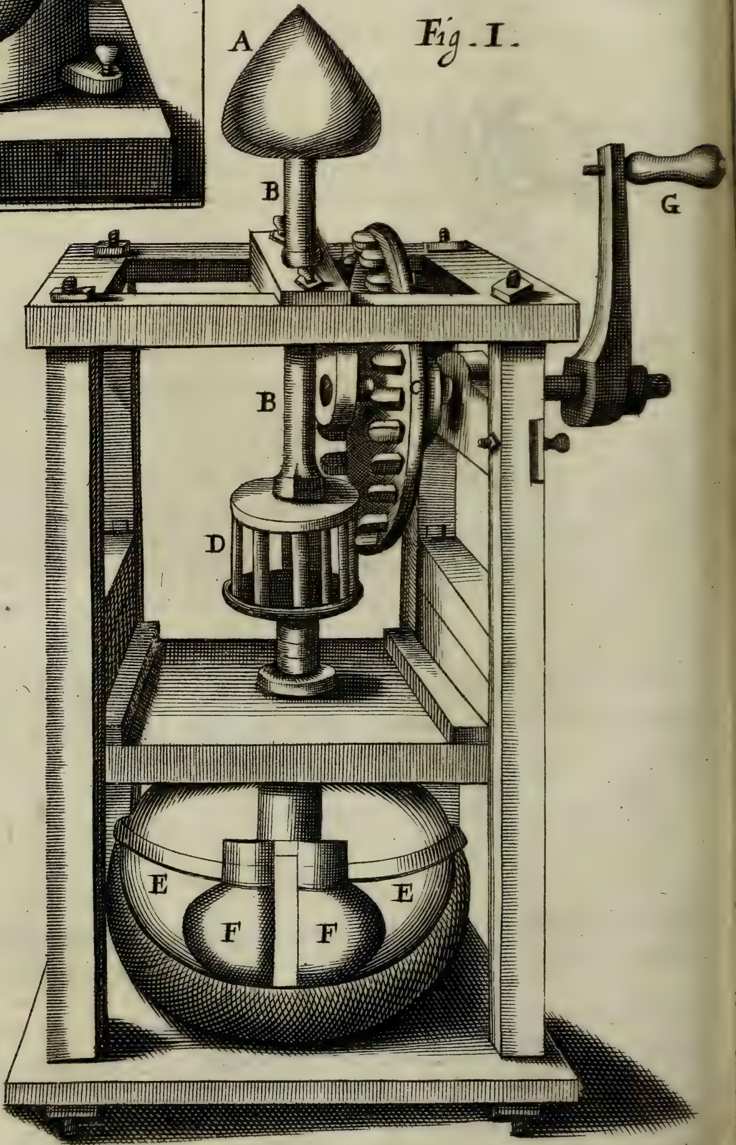


Fig. I.



Numb. 87

PHILOSOPHICAL TRANSACTIONS.

For the moneths of *September* and *October*.
Octob. 14. 1672.

The CONTENTS.

An Extract of an Epiſtle of Dr Langelot, *repreſenting, Of what great uſe* Digeſtion, Fermentation, Triture *or* Grinding, *if they were well regarded, might be in Chymiſtry ; and proving it by very conſiderable Experiments, ſaid to have been made by himſelf. An Extract of a Letter of Mr.* Liſters, *enlarging his former Notes about* Kermes; *and withal inſinuating his conjecture of* Cchineil's *being a ſort of* Kermes. *A Letter written from* Florence *by Mr.* Tho. Platt, *containing divers remarkable Experiments, there made upon* Vipers, *ſince M.* Charas's *ſecond Reply to Sig.* Franc. Redi. *Doctor* Wallis's *Anſwer to the Book, entituled* Lux Mathematica, &c. *The ſame Doctors Additions to what he lately publiſh't in his Works* De Motu & Mechanice, *concerning the* Center of Gravity *of an* Hyperbola. *An Accompt of ſome books :* I. *Tractatus de VITA NATURÆ: &c. Auth.* Franc. Gliſſonio, *Med. D. & P. &c.* II. Jeremiæ Horroccii *Opera Poſthuma, unà cum* Crabtræi *Obſervat. Cæleſtibus, nec non* Joh. Flamſtedii *de Temporis Æquatione Diatriba, &c.* III. Marc. Malpighii *Diſſertatio Epiſtolica de FORMATIONE PULLI in OVO.* IV. *De MENTE HUMANA Libri quatuor; Auth.* J. B. *du HAMEL.* V. *A Letter of* Franceſco Redi *concerning ſome Objections made upon his Obſervations about* Vipers ; *together with a Reply to that Letter by* Moyſe Charas : *now both Printed in Engliſh.* VI. *De* Gemmarum Origine & Viribus *Exercitatio ; A.* Rob. Boyle : *Now Printed in Latin.*

An Extract of a Latin Epiſtle of Dr. Joel Langelot, *Chief Phyſitian to the Duke of* Holſtein *now Regent: Wherein is repreſented, that by theſe three Chymical Operations,* Digeſtion, Fermentation, *and* Triture, *or Grinding, (hitherto, in the Authors opinion, not ſufficiently regarded) many things of admirable uſe may be performed.* *Engliſh'd by the Publiſher.*

AFter that this Learn'd and Experienced Phyſitian and Chymiſt had often with himſelf conſider'd, what the Reaſon might be, Why the chief Chymical Operations had been hitherto contemned, and by ſome reputed even for Chimæra's; he affirms to have found at laſt, that the true cauſe thereof is, that the Artiſts have not made uſe, as they ſhould, of thoſe means and ways, that would have made them ſucceſſeful.

Now of thoſe means he aſſureth by his own certain experience theſe three to be the moſt eminent and the moſt admirable for uſe, viz. *Digeſtion*, *Fermentation*, and *Triture*; operations ſufficiently diſcourſed of, but, in his opinion, little underſtood as to their efficacy and uſefulneſs, which he here undertaketh to make out by ſome conſiderable and un-common experiments; thereby to encourage thoſe that are ſtudious of Chymiſtry, and to keep them from deſiſting when they ſhould moſt purſue their work, as alſo from deſpairing of the ſucceſs of this or that Operation though in appearance dubious.

Firſt then he ſhews the excellent uſefulneſs of *Digeſtion* * in the Preparation of the *Volatil Salt of Tartar*. Where having mention'd the difficulties and unſucceſsfulneſs in other Proceſſes, tryed by him, he aſſures us, That as ſoon as he made uſe of a *long Digeſtion* he ſucceeded ſo well, that the very firſt time he obtained, what he feared he ſhould not have gotten by many *Cohobations*; which was, a pure white Volatil Salt of Tartar, leaving behind a few, quite inſipid, *feces* of an earthen colour.

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* Compare herewith, what our Noble Philoſopher, *Robert Boyle*, many years ſince hath publiſh'd of the great Uſe of Digeſtions, namely in his *Hiſtory of Fluidity* and *Firmneſs*, the firſt part, Section 12*th*. printed in *London* 1661. among other *Phyſiological Eſſays*, where he ſaith: *This Intimation I ſhall add for the ſake of Philoſophers, that barely by* long Digeſtions(*and much more if they be helped by ſeaſonably repeated Diſtillations,*) *in exactly ſtopt Veſſels, and a due degree of heat, there may be made in the parts of many bodies, both Vegetable and Animal, ſo great a change from the ſtate of conſiſtence to that of Fluidity, as thoſe that contenting themſelves with ordinary courſes of Chymiſtry, have not had a peculiar curioſity for tryals of this nature, will not be forward to expect.* This was alſo printed in Latin the ſame year.

To this he adds another great uſe of *Digeſtions*, in duly preparing the *Eſſences of Mineral Sulphurs*; inſtancing by an experiment made upon *Corals*, as moſt clearly of all repreſenting that great power of Digeſtions. He poured then ſome years agoe upon fragments of *Red Coral* an Oyl, which among all diſtilled Vegetables is, as far as he knows, the mildeſt; deſirous to try, whether he could extract a Tincture therewith. But finding after a long time no change at all in the Coral nor Oyle, he laid by all thoughts of it. But having one Winter other things to digeſt in a digeſting Furnace, he thought good to reſume that Corallin Operation, and to give the Bolt-head, wherein that matter was yet contain'd, a place there, not without good ſucceſs. For within a moneths time, when he ſtirr'd it as he uſed to do, he perceived, that the bitts of Coral had a higher colour, and were grown ſofter, yet without any change in the Oyle. He therefore continued the ſame degree of heat, and after ſome days ſaw, to his wonder, That the Corals were altogether diſſolved into a *very red Mucilage*, yet the Oyl ſtill ſwimming upon them in their priſtin form, without having received any tincture at all. He did ſhake the veſſel vehemently and often, to ſee whether he could unite the Oyl with the Mucilage of the Corals; but all was in vain, the Oyl ſtill aſcending when the veſſel was at reſt, and the Mucilage ſubſiding. Whereupon he tried, whether he could combine them by digeſtion; but that alſo not ſucceeding, he powred off the Oyl (which he found to retain almoſt its former ſcent and taſte) and powred upon the remaining Mucilage ſome Tartariſed Spirit of Wine, of which by a ſhort digeſtion it was reſolved into a highly red Tincture.

By theſe two Experiments the Author thinks, he hath made it evident, of what value the hitherto neglected works of Digeſtion are; as alſo given a hint of the great efficacy there is in Volatil Salts, if they be fetter'd, and kept from avolation.

Secondly, to ſhew the power and uſe of *Fermentation* in Chymiſtry, he inſtances firſt in a *true Volatilization of Salt of Tartar* by means of the ſame, paſſing by what he ſaith he hath perform'd thereby upon *Antimony*, *Pearls*, *Coral*, &c. to be communicated hereafter, in his intended full Deſcription of the Operations made in the famous Laboratory of *Gottorp*. He ſaith then, that to obtain the Spirit of the Volatil Salt of Tartar, he proceeded thus; He took of crude Tartar, 2, 3 or more pounds (according to pleaſure) and firſt calcined it ſlightly and only to ſome blackneſs, to have, what is moſt neceſſary, a ferment to ferment the Tartar with. Having put this into a large pot, he poured on it ſo much water, that it ſtood an inch high above it: Then he gave it at firſt a gentle fire to make it lukewarm; which done, he powred into it half a handful of finely pulveriſed Tartar, and ſhortly after ſaw ſome bubbles ariſe, that increaſed more and more. Which perceiving he continued as he had begun, at ſeveral times to poure in more powder of Tartar, whereby the fermentation was raiſed and quickned, the bubbles thereupon riſing in ſo regular an order, as if they had been natural grapes; the colour excepted. But here he was to keep a very exact regiment of the Fire, ſuch as all Fermentation requireth; and took care alſo, leaſt by a too copious affuſion of the ſaid powder the Ebullition ſhould grow too vehement, and the pot run over. The fermentation ceaſing, he put all that was in the pot into an Iron Bolt-head (a Glaſs one being in danger to be broken,) to which he often apply'd a wet linnen cloath, thereby to hinder a too great boyling up of the fermented Tartar, which elſe will ſuddenly run up, and paſs into the Recipient it ſelf. Wherefore the fire is alſo very carefully to be govern'd, and increas'd by little and little; though at laſt it muſt be ſtrong, to force up all the Salt. Which being obſerv'd by him, he found the groſs and feculent Tartar by the ſaid Fermentation ſo volatilized, that there remain'd not any fixt ſalt in the *Caput mortuum*. Which he ſaith he hath experienced more than once. He adds, that the liquor obtained from thence, having much water in it, added for the ſake of the fermentation, is alſo to be much rectified, and that ſo far, till it appear whitiſh; which ſhews that it holds a due quantity of Volatil Salt. Which Salt, of what value it is, this Author would have us eſtimate from the teſtimony of *Van Helmont, c.* 15. *de Feb.p. m.* 780. and from the wonderful virtue, himſelf ſaith to have found in it, both in internal and external affections of the body, and even in Gangreens themſelves; beſides that by means thereof he hath prepar'd ſome eſſences, which in vain he had tried to make by other *Menſtruums*.

Another inſtance he gives us of the great uſe of *Fermentation in Separating impure and noxious Sulphurs:* which he preſcribeth to try in *Opium*, whereby, according to him, it becomes not only a very ſafe medicine, but alſo a highly uſeful one for very many caſes, if rightly uſed.

Take then, *ſaith he*, of true Theban *Opium*, ſliced, one pound; and pour upon it in a low Cucurbit ten pounds of freſh Juyce of Quinces very ripe, adding to it one ounce of pure and very dry Salt of Tartar; expoſe it to a gentle heat for a day or two, untill there appear ſome bubbles, which is a ſign of the fermentation at hand. Then, to further the ſame, add four ounces of ſugar very finely pulveriſed, and obſerve ſtill ſuch a degree of heat, as Fermentation requireth; which by ſo doing will duly proceed, and you ſhall ſee the *Opium* manifeſtly riſe and diſſolve *per minima*; taking heed mean while of the ſtrong-ſcented ſtupifying Sulphur, which then is wont to ſteam out. You'l then alſo ſee a part of the impure volatil Scum to emerge at the top, & the more terreſtrial to ſubſide at the bottom of the veſſel; the purer part ſtaying in the middle, which is a red liquor, like a Ruby, tranſparent; which you are with care to ſeparate, filtrate, and by a due diſtillation to thicken to the conſiſtence of hony. And this you muſt again diſſolve by an highly rectified Spirit of Wine, filtring it, and digeſting it for a moneth, that whatſoever of crude there may yet be in it, may be by that celeſtial fire ripened and brought to perfection. This Spirit being abſtracted to a due conſiſtency, you will find this Eſſence to be of that virtue, that the fourth part of a grain, or at moſt half a grain, taken in a proper vehcle, moiſt or dry, will perform very wonderful things.

Having diſpatch't Digeſtion and Fermentation, he comes to *Trituration*, his laſt; by which alone he eſteems many great and admirable things may be performed in Chymiſtry. To which he is perſwaded he ſhall very eaſily obtain the aſſent of all thoſe, that ſhall but obſerve and well conſider the two following Operations, both experimented in the Laboratory of *Gottorp*, in the preſence of the late Duke *Frederick*, a Prince exceedingly well verſed in all kind of knowledge, eſpecially in that of Chymiſtry.

The firſt Operation was made upon *Gold*; which, though the moſt fixed of all bodies we know, was, though it will not yield to Fire nor to any other known diſſolvent, maſter'd by *Grinding*; which he aſſureth himſelf to have been an eye-witneſs of. But this it did by means of a ſingular Inſtrument,by him call'd a *PhiloſophicalMill*,whoſe ſtructure is thus deſcribed.

Tab.I. Fig. I

A. *A Leaden Head pretty thick.*
B. *The Axis.*
C. *An indented Drum.*
D. *A Drum conſiſting of Coggs.*
E. *A Mortar.*
F. *Peſtles.*
G. *A Handle, by which the Mill is turn'd.*
a. *The Superior part of the Axis, which is round.*
b. *The Inferior part of the ſame, which is ſquare.*
c. d. *Here both the Peſtles are affixed to the Axis.*
e. *Here the Peſtles are ſtrengthened by a ſtrong Braſs-ring.*
f. *Here both Peſtles are ſtrengthen'd by two Braſs-caſes.*
g. *Both the thick peſtles of glaſs.*

Follows the Operation it ſelf.

Put Leaf Gold, as much as you pleaſe, cut very ſmall, into a very thick Glaſs-mortar, or into one of Gold, (ſuch an one as the late King of *Denmark*, a little before his death,cauſed to be made for this operation :) In this Mortar, covered only with paper,leſt any duſt or other thing ſhould fall in, grind the ſaid gold night and day by an uninterrupted agitation of the Mill, till you ſee it reduced into a duskiſh colour. For which grinding there are commonly to be allow'd 14 days and nights. But if you will only work by day, there will need a whole moneth. This done, put the powder into a Retort, not very deep,but ſhallow,ſuch as the Engliſh ones uſe to be;and drive it by a fire of ſand by degrees,but at laſt by a very ſtrong one;& there will come over a few but very red drops,which being digeſted either *per ſe*, or with Tartariſed Spirit of Wine, give you a true *Aurum potabile*, which is ſincere, and un-imbued with any forrain quality.

The Remainder though they could alſo have eaſily reſolv'd by Grinding ; yet they thought good to make an Extract of it by means of their Philoſophical *Acetum*, made of *Verdigreaſe*, Sulphur, and a highly rectified Spirit of Wine, by a long digeſtion : Whereby they got again a Tincture ſufficiently red and of very great virtue. And that little that remained, which was but very little, they reduced into a body by the means of Borax ; but it wanted its due weight.

'Tis true, *ſaith our Author*, that at the firſt view this operation ſeems to be groſs, requiring much time and labour, but little Art; but well conſidered 'tis highly admirable, being aſſiſted by the wonderful Salt of the Air, as the only Catholic diſſolvent. And that that Salt is by the continual Grinding attracted and intermixt, many other Experiments, made by him about it, have taught him, which he reſerves for the publication, hereafter to be made of the things done in the Gottorpian Laboratory.

The *ſecond* Experiment of the uſe of this *Grinding*, was in a true and genuine preparation of the *Mercury* of *Antimony*: A proceſs affirm'd not only made by himſelf before his Prince, but alſo by the hands of that very experienced Chymiſt of the Elector of Saxony, *Johannes Kunckelius*: to have more than one ſtring to his bow.

The Operation conſiſts in this; Grind firſt the *Regulus* of *Antimony* into an impalpable powder; and to one pound of it, add two pounds of very pure and dry ſalt of Tartar, and eight ounces of Sal Armoniac; and mix it well together. Then moiſten it with ſome Urine of an healthy man, eſpecially of one that drinks wine, if ſuch may be had; and take care, to have this mixture ground for a whole day together without any intermiſſion by two very ſtrong young men; always, if there want moiſture, ſprinkling Urine upon it. Then put this mixture into a Bolt head and powre ſo much Urine upon it, that it may ſtand three inches high over it, and cloſing it well, keep it in digeſtion for a whole moneth, daily ſhaking it. And if during that time the maſs appear to be dry, powre on more Urine. The Digeſtion being ended, form the matter into globuls with equal parts of beaten glaſs and calx vive, and dry it in the ſhade. Of theſe, extract the Mercury in manner following;

Let there be ready an oblong iron veſſel, like a Bolt-head, into which powre cold water, and dig it into the ground: Upon it put an Iron plate with many holes in it, and lay thereon the ſaid globuls well dry'd; Then fit alſo an Iron head, ſomewhat flatted, to it, that you may conveniently lay coals thereon, and thus keep a moderate fire for four hours: then increaſe the fire for as many hours, unto the laſt. After that, let it cool, and beware, not to ſtir the veſſel digg'd in the ground, nor to pour out the water, before that be altogether cooled;

or elſe you will looſe a great deal of the Mercury;as happen'd, it ſeems, to our Author, when his Prince, being impatient of delay, commanded the water to be poured out before 'twas time: For the Mercury, being by ſo ſtrong a fire reſolv'd into Atoms, is to be coagulated again by Cold.

This Mercury of Antimony our Author glorieth in, as having prepar'd and handled it with his own hands, and ſeen it with his own eyes, after the finiſht diſtillation, rnnning in the bottom of the veſſel. Neither doth he care, if any do ſtill call it a Non-Entity; or if any unwary Laborants be unſucceſsful in the operation. It is ſufficient to him, that he hath nothing alledged, but what he hath tryed himſelf, and candidly deſcribed. He wiſheth ſuch Operators to conſider, how many things there are to be obſerv'd before and in the operation, and even after it, if you will be certain thereof. Which he ſaith may plainly appear even by the Operation of the Tartar alone; foraſmuch as all Tartar is not equally good, and himſelf hath met with great diverſity of the ſame: Beſides which great care is to be had of the Fermentation it ſelf of the Tartar; for if it be not duly made, the Tartar will not be reſolv'd *per minima*; nor will the Grapes be repreſented in that natural ſhape they ought to be;nor will all the Salt,(which is the main thing) be volatilized. Further,if perhaps the fire be exceſſive during the Diſtillation, much of the Volatil Salt will be burnt up, and it will yield a ſtrong-ſmelling Spirit.

Having diſpatch't this, the Author ſubjoyns an accompt,he met with among his Papers, of another way of Operation of *Grinding* of *Gold*; which though he have not yet tryed, yet it ſeeming to him very likely to ſucceed, he ſcruples not to communicate alſo. The inſtrument,to be uſed therein, he deſcribes thus.

Tab. I. Fig. II.

a. *A Mortar of very fine Steel.*

b. *A body ſerving for a Peſtle, of the ſame Metal, which is to fit the Mortar, as 'tis delineated in the Figure.*

c. *Is a ſmall ſpace, where is interpoſed a golden Plate, half a Ducat thick.*

d. *The handle, by which the Peſtle is to be managed in the work of Grinding, which is to be continued for three weeks; at the end of which the Gold will be reſolved into a potable liquor.*

This way, as it is much ſimpler, ſo 'tis by the Author eſteem'd much more expedient than the former, by reaſon of the Sulphury-ſaline quality of Iron, which by Grinding being open'd and highly ſubtilized, acts the more powerfully upon the moſt ſolid body of Gold, and attracts withall the Salt that is in the Air in greater plenty, than can be done in a Glaſs or Golden Mortar. And if it be objected, that by that long continued Grinding the ſteely particles are worn off and commixt with thoſe of the Gold; The Author would have it conſider'd, how great a Cognation there is between thoſe Sulphurs, and alſo, how great is the Uſe of Digeſtion, ſeparating the pure from the impure, and withal exciting that occult fire of *Mars*, well known to the true Searchers of Nature; which, being aſſiſted by the *Alcool* of Wine, is able to concoct the little immature portion to a due maturity.

An Extract of a Letter of Mr. Liſter *to the Publiſher, both enlarging and correcting his former Notes about* Kermes; *and withal inſinuating his conjecture of* Cochineil's *being a ſort of* Kermes.

Sir,

WE muſt correct as well as enlarge our Notes concerning *Kermes*[*]; and yet there will be much difficulty in reſolving the queſtion concerning the Original and Efficient of *Kermes*. Theſe things are certain.

1. That we have this year ſeen the very Gumm of the *Apricock* and *Cherry-lawrel-Trees* tranſudated, at leaſt, ſtanding in a Cryſtal-drop upon ſome (though very rarely) of the tops of theſe *Kermes*.

2. That they change colour from a yellow to a dark-brown: that they ſeem to be diſtended and to wax greater, and from ſoft, to become brittle.

3. That they are fill'd with a ſort of *Mites*; that ſmall powder (which I ſaid to be Excrement,) being *Mites* as well as that *Liquamen* or ſofter pulp (which I took to be Bees-meat;) concerning both which particulars I am pretty well aſſur'd by my own, and alſo by my ingenious friend, Dr. *Johnſon of Pomfret's* more accurat Microſcopical Obſervations.

[*] *Compare herewith, what was publiſh't in* No. 71. p. 2165. No.72. p.2177. *eſpecially* No.73. p.2196.

4. That the Bee-grubbs actually feed on Mites, there being no other food for them.

5. That there are other *Species* of Bees or Waſps beſides thoſe by me deſcribed; which are ſometimes found to make theſe Mites their food: Dr. *Johnſon* having open'd one Husk, with one only large Maggot in it.

6. That there are probably different ſorts of Mites in theſe *Huskes*, making poſſibly different *ſpecies* of Kermes: For, ſome I have found to hold Carnation-colour'd Mites, encloſed in a fine white Cotton, the whole Husk ſtarting from the Twigg, ſhrivelling up, and ſerving only for a Cap or Cover to that company of Mites. Other Mites I have ſeen white, and (which is moſt uſual) the Husks continuing intire and not coming away from the Twigg they adhere to, and but little Cotton at the bottom. Thoſe of the firſt ſort are the white Cob-webbs on the Vine, deſcribed by Mr. *Hook Micrograph.* Obs. 56.

7. That the ſhrivell'd Cap to be found upon the Mites incloſed in Cotton, as alſo the whole Husk it ſelf, if taken early in *April*, while ſoft, will, dried in the Sun, ſhrink into the very figure of *Cochineil*: Whence we gueſs, that Cochineil may be a ſort of *Kermes*, taken thus early and ſun-dried.

See Numb. 20. p. 362.

Hitherto this Summers Notes concerning *Kermes*. This advantage at leaſt we may have by them; that the account, taken from M. *Verney* by Dr. *Croon*, and publiſh't in one of the *Tranſactions*,* is made more intelligible: the ſmall Scarlet powder, there mention'd, being to be underſtood of thoſe Mites; and they to be diſtinguiſh't from the Bee-grubbs, which are chang'd into the Skipping Fly, that is, the Bee, (for kind at leaſt) by us deſcribed formerly, I am, *&c.* *York Octob.* 9. 1671.

An Extract of a Letter Written to the Publiſher by Mr. Thomas Platt, *from* Florence, Auguſt 6. 1672. *concerning ſome Experiments, there made upon* Vipers, *ſince Monſ.* Charas *his Reply to the* Letter *written by Signor* Franceſco Redi *to Monſieur* Bourdelot *and Monſieur* Morus.

Sir,

I ſhall begin with telling you, that in a Converſation laſt Winter, where I had the good fortune to make one of the number, the diſcourſe was of an Opinion of M. *Dela Chambre*, who, to prove that the Spirits are animated, alledges, among other arguments, their Aptneſs to diſcern; by which he ſuppoſes, that in the heat of their anger they gather the Poiſon from the ſeveral parts of the blood, and therewith convey themſelves to the teeth of the irritated animal, from whence they are afterwards transfuſed into the wound by biting. This conceit was by ſome of the Company received with much applauſe, becauſe they knew, how difficult a thing it was, to come to an explanation of that poiſon, which M. *Dela Chambre* makes mention of in general, That the ſpirits proceed from the Blood of the irritated animal. So they agreed, *paucis mutatis*, hence to frame a new *Hypotheſis*, ſaying, That ſuch poiſon is nothing elſe but a new and malignant activity of the ſame Spirits whilſt they are vexed and bent towards revenge; aſſerting the truth of ſuch Ideal effects with divers examples, as that of the Toad, the Weeſel, the Mad Dog, the Spider of *Puglia*, &c. which were all found very weak and un-concluding.

Wherefore moſt of the Gentlemen did incline to entertain Monſ. *Dela Chambre*'s firſt fundamental Opinion, ſince at leaſt that ſuppoſes, That thoſe Animals, that poiſon by their biting, have already a real poyſon within themſelves, and that Anger works no other effect, but to gather all the venomous parts together in one particular place, whence they may eaſily be inſtill'd into the wounds, made by the teeth.

For all this, (as it moſt commonly happens in ſuch diſcourſes,) everyone remain'd in his own Opinion; and mention having been made of that of Signor *Redi's*, held in his Book of Vipers, which for ſeveral years paſſes in this Country almoſt for an undoubted truth, *viz.* That the Vipers poiſon conſiſts in ſome thing, incompatible with this new allay of M. *dela Chambre*'s opinion, reduced to the irritated Spirits, though not with that of his, which is taken purely from its firſt grounds: This gave occaſion to a new debate concerning the validity of Sinnor *Redi*'s Aſſertion, ſo generally received here: ſome ſaying, it would do well to examine the grounds of it. Upon this it was reſolved, that all might be ſatisfied, to come to a tryal as ſoon as the Spring would give leave to Vipers to appear abroad.

Now, Sir, you muſt know, that being at the houſe of Sign. *Magalotti* on the 2*d* of *June* laſt, there came Dr. *Francini*, who had formerly been one of the moſt reſolute Aſſertors of this opinion of Signor *Redi* concerning the Poiſon of Vipers; and being come he ſent to his lodging for a Box, in which there were a great many heads cut off, that morning, of Vipers lately come from *Naples*. He immediately deſired to have ſome Animals to begin his Experiments upon; but there being at that time no other company with Signor *Magalotti* but his brother and I, it was thought fit to ſtay till next morning, that thoſe Gentlemen, who were at the diſpute laſt Winter, might be preſent; as it fell out they were.

I, that had not ſo much patience, deſired the Doctor to make at leaſt one experiment; which being granted, Signor *Magalotti* was pleaſed to ſend to the publick Market for a couple of Pigeons, to be ſure of having ſome, that were not prevented by any Antidote. The Pigeons being come, the firſt was wounded with the Teeth of a Vipers head that had been cut off about 7 or 8 a clock the ſame morning. The way of making the wound was, by thruſting twice the Maſter-teeth into the fleſhy part of the Pigeons breaſt, till ſuch time as preſſing the upper part of the Jaw, the two little bladders, that ſerve as gums to the teeth, did empty out upon the wound ſome of that yellow liquor, which here is ſuppos'd to be the true and only poiſon of the Viper. This Pigeon being thus bit, and ſet upon the ground, began to ſtagger immediately, and dyed in leſs then 3 or 4 minutes. The ſecond Pigeon was wounded in the ſame manner; but at the firſt wound there only entred one of the teeth, which brought forth a great deal of blood; the ſecond time they both enter'd, and this had the ſame fate, with this difference only, that he languiſh't half a quarter of an hour.

The next morning there met at Signor *Magalotti*'s Chambers, beſides the company of the day before, Signor *Carlo Dati*, Sign. *Vincenzo Viviani*, Sign. *Paolo dell Ara*. Dr. *Savona*, Dr. *Neri*, Dr. *Fabrini*, and ſome others. Whereupon ſix Pigeons and a Cock having been brought; the firſt thing that Dr. *Francini* did, was, to thruſt ſeveral thorns of Roſe-ſhrubbs into the breaſt of one of thoſe Pigeons, to manifeſt, that ſuch accidents, as might befall thoſe that ſhould be wounded by the Teeth of the dead Vipers, were not meerly cauſed by the wound. And whereas one of the company began to make ſome nice reflexions, and to take ſome of the heads to meaſure the juſt proportions of their teeth, to ſee what difference there might be betwixt them and the thorns, this made the Doctor looſe patience; and ſoon taking a pin, which was none of the leaſt, he gave to the firſt Pigeon, that he could lay hands on, a very deep wound in the breaſt, which no ſooner was got free but began to leap & frisk about the room, as if it had not been concern'd in the leaſt.

After this, they began in good earneſt. For another Pigeon was taken and bit in the breaſt by both the Maſter-teeth of a Vipers head, that had been cut off the morning before; the execution being exactly like that of the day before. The effect was, that the Pigeon had the ſame ſhaking fits; after which falling upon his belly he died, giving ſignes a little before of a painful Agony, by his often gaping. His end was not only very ſenſible to him, but alſo more tedious than that of the other day; for, this lived 5 or 6 minutes after his wound. Another having been ſerv'd after the ſame manner with another head, had the like accidents, and died within a quarter of an hour: This Obſervation was made on this other, that his wound let out a great deal of blood; whereas not ſo much as one drop was ſeen to come out of any of the others.

All this appearing as yet but little to the Doctor, to exclude the doctrine of Spirits, which now began to looſe ground after ſo many experiments of *Dead* Vipers heads; he took three ſtalks out of a Broom, and having ſmoothed them, and ſharp-n'd them at the ends after the manner of a Lancet, he drew from the gums of ſeveral heads enough of that yellow juice to dawbe two of thoſe ſtalkes; which, being thus moiſtned with that liquor, were both put into thebreaſts of two Pigeons, and there left; the like having been done to another with the 3*d* ſtalk not cover'd with that juice, which was at leaſt one third part bigger and longer than the other two. In a word, the two firſt died within 4 or 5 minutes, and the laſt continues to this very day in Signor *Magalotti*'s Pigeon-houſe as brisk and as fat as ever; his wound in his breaſt, inſtead of having cauſed an Inflammation, is now almoſt perfectly healed.

Whilſt theſe Experiments were making, it came into the heads of ſome to try another, upon the relation that Sign. *Paolo dell' Ara* (lately come from *Paris*) had made; which was, that ſome had aſſerted there, that, to ſwallow a Vipers head was a moſt certain Preſervative and Remedy againſt the biting of a

Viper. Dr. *Francini* ſmiled at that phancy; but to give full ſatisfaction about it, he made two experiments. The one was, by making the Cock that was there to ſwallow a Vipers head, and then cauſing him to be well bitten in both thighs by a live one. But the Cock continuing ſome time before he gave any ſigns of ſickneſs; not to looſe time, he paſs'd to the other experiment, by thruſting the Teeth of a dead Vipers head *into* another pigeon, that had before got down one of thoſe heads into his belly. The concluſion was, that both dyed, the Cock within a quarter of an hour, & the Pigeon in leſs than 4 minutes.

The news of theſe Experiments made many perſons curious to ſee them perform'd once more; ſo that, ſome few days after, a rendezvous was made in Sign. *Magalotti*'s Garden, where, beſides the forenamed perſons, met Mr. *Thomas Frederick*, Mr. *John Godscall* (two Engliſh Gentlemen,) Abbot *Strozzi* (his Moſt Chriſtian Majeſties Publick Miniſter in this Court,) Sign. *Paolo Falconieri* (firſt Gentleman of the Bed chamber to the G. Duke) Sign. *Luigi del Riccio*, Monſ. *Pelletier*, Monſ. *Morelle* (the one Phiſitian, and the other Chirurgion to the G. Dutcheſs,) Dr. *Gornia* Phyſitian in Ordinary to his Highneſs, Dr. *Bellini* Profeſſor of Anatomy at *Piſa*, Sign. *Lorenzo Lorenzini* a Mathematician, and Sign. *Pietro Salvetti*.

But by the by, give me leave to tell you (for ſome diverſion,) that this Sign. *Salvetti*, who is one of the G. Dukes Muſitians, & plays on all Bow-Inſtruments, invented about 4 years ago a New tuning of the Antient *Lira Viol* with the uſual 13 ſtrings; by means of which tuning it is rendred wholly perfect, ſo that you may expreſs upon it all Concords, Diſcords, and alſo the imperfect Concords, as ſeavenths, ſixths, &c. as well as upon any Virginal that hath the quarters of Notes upon it. 'Tis true, 'tis only for Melancholly and paſſionat matter, and not for diviſion, as is the proper nature of the *Lira*. I ſhall only add, that with the aboveſaid tuning he aſcends in *Alte* as high as *G, Sol, Re, Ut*; and deſcends as low as double *C, Sol, fa, ut*; and can make every where the ſame Concords as above.

This ſame perſon having applied himſelf to the ſtudy of the Mathematicks, and particularly about the *Proportions* of *Harmony*, relating to his profeſſion of Muſick, began to delight himſelf in *Opticks* and other parts: And not being content with the Theory, he went on to put it in practice by making Teleſcopes of divers ſizes, as alſo Microſcopes, in imitation of thoſe of *Divini* and *Campani*. And I can tell you, that he lately ſhew'd one of his Microſcopes to the G. Duke, which was judged by all much better than any of the beſt his Highneſs hath; and I was an eye-witneſs to this, that for magnifying, defining, and clearneſs, it was found very excellent. The ſame day he likewiſe ſhew'd his Highneſs a little Proſpective Glaſs, made according to Mr. *Newtons* new Invention; and though this was but the firſt, and was not above half a foot long, it had the ſame effect of one of two. He is now making another after the conceit of M. *Caſſegrain*, though he agrees not with him in making convex the little Speculum, which one looks into through the Eye-glaſs; but believes, the French Author only deviſed that to diſguiſe as much as was poſſible his pretended New Invention, which he endeavors to make anterior to Mr. *Newtons* moſt noble one. For the reſt, he thinks he hath found a way of making Objects ſeem right with one only glaſs.

But, to return from this digreſſion to our firſt diſcourſe, you may take notice, that the Aſſembly at Signor *Magalotti*'s, having been firſt inform'd by Dr. *Francini* of the grounds of this diſpute and of the former Obſervations, he began the ſame experiments by cauſing 2 Pigeons to be bit by a Vipers head that had been dead above ten hours, in ſuch a manner that by preſſing the gums ſome of that yellow liquor might drop into the wound. They both died, one in 6 minutes, and the other in 8; and not being content with this, with another Vipers head they poiſon'd a Chicken, which died in 10 minutes. There appear'd afterwards another Pigeon, that had been wounded, many hours before, by a dead Vipers head; but it had been dead ſo long, that the liquor, quite dried up in the gums, was become ſo hard, that for all the ſqueeſing of it nothing would come to the teeth; whence this Pigeon was very well: And Dr. *Francini* having cauſed the ſame bird to be bit again by the ſame dried head, it had after a little fluttering with his wings, whilſt the pain of the biting laſted, no other harm.

A live Viper then being taken, 4 Chickens were bit by it one after another. The two firſt, either becauſe the liquor did not penetrate into the wound, or the blood expelled it, appear'd not to have any diſtemper. The *4th* look'd as if it would dye preſently; but a little after coming to himſelf he got clear off for that time. But the third, who ſeem'd at firſt to be very lively, dyed within an hour and an half.

There being afterwards a young Bitch brought in of a pretty ſize, ſhe was bit twice by a live Viper in the middle of the hanging part of the ear: Whereupon ſhe very ſoon began to give mortal ſigns, by ſtaggering, vomiting and being convulſed; after which having a little recover'd her ſelf, the ſame accidents return'd upon her, by which ſhe was reduced to ſuch a grievous condition, that four hours after her being bit ſhe could not ſtir any more, and ſeem'd juſt as if ſhe had been dead, holding out her tongue, and looking very gaſhly, without any other ſign of life than that of painful breathing; to which ſhe added ſometimes a faint barking and a languiſhing howling. In which condition ſhe was ſtill found next morning, only her reſpiration was yet weaker, and ſhe appearing juſt a drawing to her end. It was obſerv'd, that no part of her body was ſwell'd, nor had any ſpot upon it. She had voided backward ſome matter of a very black colour, of which her hind parts being very foul, a ſwarm of Gnats and Waſpes were devouring her alive: Which mov'd one of the ſervants of the houſe, to knock her in the head.

After this, there were bit two Capons and a Pullet by a freſh Viper, vexed a purpoſe; and, becauſe they gave not then any ſigns of being ill, they were ſent back to their coops, and there having continued well till evening, they were ſurpris'd at night by a diſtemper, which in all likelyhood proceeded from the poiſon; for next morning one of the Capons and the Pullet were found dead.

I muſt not forget to tell you, that the laſt thing that was done, was, the ſending to the Pigeon-houſe for that Pigeon, that had in his breaſt the ſtalk that had not been imbued by the yellow liquor; where he had been kept during all that interval of time, from the firſt experiments to theſe laſt; being now found by all not only very lively, but alſo in a thriving condition. The place of his wound being ſearch't, the ſtalk was eaſily felt, and was, before the eyes of all the company, with a little pair of Pinchers drawn out.

This is, *Sir*, what I can confidently affirm to have been an eye-witneſs of; and it being not my buſineſs to make reflections upon theſe experiments, I leave that to you. I know, I have not ſaid any thing but what will be moſt amply found in Sign. *Redi*'s firſt and 2*d*. book; but that, which urged me to make this repetition, was the thoughts that it might be acceptable to you, to ſee his Aſſertions confirmed by the Teſtimonies of ſo many perſons, that are the more able to be judges of them, becauſe their underſtandings are ſuch, that 'tis not poſſible to impoſe upon them.

If I may be ſo happy as to receive ſometimes from you an account of the Curious performances of your famous *Royal Society*, I ſhall make uſe of that favour, to animate the *Virtuoſi* here to do ſomething that may not be unworthy of your knowledge: But before you afford me this honor, I muſt firſt beſeech you to lay your commands on me, by the execution of which you ſhall plainly ſee, with how much reality I am, *&c.*

Dr. John

Dr. *John Wallis* his Anſwer, by way of Letter to the Publiſher, to the Book, Entituled *Lux Mathematica*, &c. deſcribed in *Numb.* 86. of theſe Tracts.

Clariſſimo Doctiſſimóq; Viro.
Dom. Henrico Oldenburg, *Soc. Regiæ Secretario*, Johannes Wallis, *Geom. Prof. Oxon. Sal.*

Clariſſime Vir,

Vidi Ego, præteritâ ſeptimanâ, *Hobbii* quem memoras librum novum, cui titulus *Lux Mathematica.* Quòd autem *Authore R R.* dicatur, factum credo, ut ſit qui *Hobbium* collaudet, ſi non Alius, ſaltem aliis literis inſignitus Idem, (*Roſeti Repertor.*) Permitto, ſi placet, ut & Stricturas noſtras dicas, Authore *R. R.* ut ſit etiam *R. R. Roſeti Refutator.*

Inter *Manifeſta* ſua, ſunt & *Manifeſti* Errores. Speciatim (ne multa memorem,) cúm *idem eſſe* vult, *Decem Pedes*, in *Decem Pedes*, atq; ſimpliciter in *Decem*, Multiplicare; & quæ hujus ſunt ſimilia non pauca. Quaſi idem eſſet, *Decem Centurias* in *Decem* ducere, atq; in *Decem Centurias*, ſeu, *Duas Centeſimas* in *Duas Centeſimas*, idem atq; in *duo*; quod ille facit p. 33. l. 27. *Quadratum* (inquit) *à duabus centeſimis æquale eſt quatuor centeſimis :* (cum dicendum erat, *Quatuor Decies-milleſimis.*) Quod quám ſit abſurdum ſi neſciat, per me licet ignoret.

Sin diſpliceat ſibi ſuum *Multiplicare* : Quis Hobbium juſſit, *Multiplicare* (de lineis) importuné dicere (quò nugis ſuis locus eſſet) quod *Ducere* dicunt alii; vel, ſi quando *Multiplicare* (ſenſu laxiore, ſed ſatis intellecto,) tantundem volunt.

Quod *Controverſiam primam*, quam vocat, ſpectat, *ex Hobbii Documento quinto deſumptum*; abundè refutavi in *Hobbio debitâ Correctione* Sect. 5. Sin adhuc neſciat, $\frac{1}{3}+\frac{1}{12}$ minus eſſe quàm $\frac{1}{3}+\frac{1}{6}$ (aut illius ad 1, rationem minorem eſſe, quàm hujus,) pergat neſcire.

De *Controverſia Secunda*; quid ſit *Ratio*, quidq; hanc inter & *Fractionem* conveniat aut interſit, abundè oſtendi, (tum alibi, tum) in *Hobbio Heautontimorumeno*, *p.* 49, &c. ubi *Hobbio Dialogo quarto* reſponſum eſt. Permitto tamen ut ille etiamnum non intelligat.

Tertiam quod ſpectat; De *Parabola* & *Parabolaſtris*, quas habuit *Hobbius* propoſitiones *Veras*, nec ſuas eſſe, nec ab eo intellectas, (ſed & unde habuerit) oſtendi, in *Elencho Geometriæ Hobbianæ* p. 83, 84 *item* 133, 134. (quas *Falſas* habet, non nego quin ſuæ ſint.) Quàm bellè demonſtraverit, ibidem oſtendi (à *pag.* 64. ad 83,) ad *Hobbii cap.* 17. Ut autem ſuas ipſe demonſtrationes *illas legitimas judicet*, ſibiq; *adjudicet*, etiamnum permitto : nempe, ut ſimilia ſint labra lactucis. Quid Ego de his, ſive in *Arithmetica Infinitorum*, ſive in *Commercio Epiſtolico*, ſive in Tractato *de Motu*, tradidi; ex ſcriptis meis ſciſcas velim, (ubi &, quid dixi, & quare, videas : non ex *Hobbio* narrante. Quod & ubique ſiq; intellectum velim; eiq; de me referenti derogandam fidem, ſubleſtæ fidei ſæpius deprehenſo.

Quòd autem, *Triangulum* (verbi gratiâ) *Parabolámve*, aliámve Figuram, etiam *Truncatam*, complentes parallelas Rectas, & eſſe *numero infinitas*, & earum tamen *tum primam*, *tum ultimam*, *datam eſſe*, ſine ſolæciſmo dici poſſit (obſtrepente licèt H*obbio*) ſatis ſum ſecurus.

Ad *Quartam* quod attinet; quid *Ductum Rectæ in Rectam*, *Numeriq; in Numerum*, adeoq; *Latus* & *Radicem*, interſit conveniátve; jam olim oſtenderam, *Opere Arithmetico.* cap. 18. 22. 25. & alibi. Item, quo ſenſu Multiplicatio *Auget* Multiplicatum. Ut non ſit opus ab H*obbio* (horum neſcio) jam edoceri.

Quòd 1 *per* 1 *multiplicari non poſſit, propterea quod quicquid multiplicatur fit plura*; à *Puero* dicendum erat, qui nondum didicerat, quid ſit *multiplicare per numerum fractum.* Sed, Quòd *decem* (pedales) *lineæ* (non in 10, ſed) *in ſe* ductæ, *faciunt* 100 (pedales) *Lineas*, *non* 100 *Quadrata*; quodq; *ſi quæratur, quoties ſunt* 10 *A in* 100 *A*, *Quotiens erit* (non 10, ſed) 10 *A*; quodq; 100 A B, ſit *id quod fit ex* 10 *AB in* 10 *AB*; (& quæ ſunt hujuſmodi;) dicenda erant (non à puero, ſed) ab H*obbio* ſolo. Et, *Algebram univerſam continere ſe debere intra fines Arithmeticæ, neq; omnino audiendam in cauſa Geometrica*; eſt, neſcientis quid ſit Algebra.

Ad *Quintam* quod habet; Quod ſcil. *Punctum* (Mathematicum) ſit *Quantum*, *& partes habeat*; *Lineaq; Latitudinem*, &c. Obtinere debet in *Geometria* H*obbiana*; utpote ſine quo ipſius Pſeudo-graphemata non procedunt, (ſed neq; hoc conceſſo;) non in *Euclidea*.

Dum verò ait, *Walliſium dicere*, *Minorem eſſe* (*non Æqualem*) Angulum Semicirculi Recto Rectilineo; &, *Angulum Contactûs dictum, quantum eſſe*; & quidem, *ejuſdem generis quantum cum Rectilineo*; (meq; hæc *authoritate Clavii docuiſſe*, *pag.* 38;) Quicunq; vel leviter inſpexerit meum *De Angulo Contactûs & Semicirculi* Tractatum, (quem ex profeſſo tueri horum contraria, eoq; nomine editum, res eſt notoria;) dubitare non poterit, quàm ſit ſubleſtæ fidei R. R.

In *Sexta*, *Septima*, *& quæ ſequuntur*; reponit ex *Roſeto* ſuo (eſto enim quamcunque Roſetum,) falſas quas dudum refutavi propoſitiones; (quaſi quidem, ſæpius repetendo, evaſuræ tandem forent Veræ.) Refutationem jam habes editam in *Tranſact. Philoſophicis* pro menſibus *Julio* & *Septembri Anni* 1671. Nec opus erit, eam toties repetere, quoties ille reponit ſua Nugamenta. Si ſibi nondum ſatisfactum eſſe queritur, Ego illud non moror; non enim recuſo quin eas ille pro Veris habeat: Alii ne ſic exiſtiment, procul omni metu ſumus.

Dicet forſan; Se vel demonſtrationes (pridem peccantes) emendaſſe vel adornaſſe novas. (Atq; id quidem, in nonnullis, conatus eſt; in multis, ne ſic quidem.) Verum hoc non facit, ut ergo novâ Refutatione ſit opus; quippe, cùm antea, non modò *non eſſe demonſtrationes* oſtenderim, ſed & *falſas eſſe* demonſtraverim, nullo unquam Novæ Demonſtrationis prætextu fieri poteſt ut evadant Veræ.

Si tamen *Tu* petis, (nam H*obbii* hac in re nullam habendam eſſe rationem

tionem autumo ;) ut ubi novæ, quas ſubornat, ψευδαποδείξεις peccent, Tibi ſaltem indicavero, (ne id ſolicitus inquiras ipſe;) ex multis pauca (ſed quæ toti ſubvertendo operi ſufficiant) ubi ſupra omnem medelam peccatur, attingam breviter.

Ad Controverſiam *Sextam*; Lepidam habes Conſtructionem, & *Hobbio* dignam: Nempe, ſi (*pag.* 13. *lin.* 6, & 9.) pro, *Radio DA deſcriptus arcus AX eſt arcus* 30 *graduum*, poſuiſſet *Punctum X ubivis, in GH rectâ*, (*etiam utcunq; productâ* ;) demonſtratio perinde ſequeretur atq; nunc ; ne verbulo quidem mutato. Quod legenti ſtatim patebit; (ſaltem inſpice hanc Figuram ; ubi ſumpto X, non Ax arcu, ſed in ipſo puncto G, non minus ſuccedunt omnia.) Ut poſſit eſſe EX quantumvis longa. (Et Hobbius, quantumvis ridiculus; nempe qui hoc ipſum pridem monitus non potuit ſecundis curis cavere.) Eſt quidem Figura noſtra, ab ſcopo ſuo, ſatis enormis ; ſed huic pariter atq; ſuæ convenit ſua demonſtratio.

Vid. Tab. II. Fig. I.

In Demonſtratione ; Falſum illud (*pag.* 14. *l.* 5.) *Erunt Fβ* & X *r æquales.* (Sunt quidem Parallelæ, ſed non *æquales.*) Adeoq; falſa quæ ſequuntur omnia hinc pendentia.

Ad *Septimam*; Objicere me dicit, quòd dixerit *Hobbius* (non quidem *dixiſſe* objiciebam, ſed quaſi ſic eſſet *arguiſſe* inſinuabam ;) *Chordas* (*in eodem circulo*) *ſuis arcubus eſſe proportionales.* Negat *ſe quod objicitur invenire poſſe.* Luſcus ſané vidiſſet. Indicaveram enim paginam, verſumq ipſum, locorum ſaltem *Quatuor* ubi hoc fit.

Curvedinem quod ſpectat ; dicit *Walliſius*, in perimetris (vel ſimilibus arcubus) circulorum Majoris atq; minoris, tantundem eſſe curvedinis ; ſed hîc in Minori, illîc in Majori, Longitudine : (pariter atq; in aliis Polygonis:) Adeóq, Minoris Curvedinem eſſe, *ſpecie* ſeu *gradu* Majorem, (propter tantundem curvitatis in minori longitudine,) non *quantitate* Majorem. Id quod in aliis qualitatibus occurrit. *Tantundem* Caloris, in *minore* mole facit *intenſius Calidum*, ſed non *plus caloris* ; h. e. Calorem fieri *gradu* majorem, ſed non majorem *quantitate*. Sic *Hydrargyri* unum Pondo, quàm unum Pondo *Stanni*, Gravedinem habet (quod ajunt) *ſpecie majorem*, ut ut *Quantitate æqualem* ; propter tantundem Ponderis in minore Mole. Quæ *Hobbius* de his nugatus eſt (& nunc & olim) apud ipſum videas ; (neq enim tanti eſt ut repetam.) Neſcit ille inter Curvedinem *quantitate* majorem, & majorem *gradu*. diſtinguere : ut ut eum illud ego expreſſe docueram, in *Hobbio Heauton-timorumeno*, pag. 98. & alibi.

Controverſia *Octava*, Cramben reponit, toties recoctam, & toties refutatam, ut jam plané ſit rancida. Quam nunc ſubornat, demonſtratio peccat ſaltem in eo (& quæ hinc dependent) *pag.* 17. *l.* 28. ubi dicitur, *non poſſunt eſſe* ; pro quo dicendum erat, *non poſſunt non eſſe.* Sed & quæ ſequuntur putida ſunt.

In *Nona*, peccatur (ut alibi, ſic) potiſſimùm *pag.* 19. *l.* 29, 30, 31. Ubi probandum ſuſceperat, puncta P, *p.* coincidere. Senſus planè turbidus eſt, ſed, ad mentem ſuam reſtitutus, hic erit ; *Quoniam Angulus pDC eſt* $\frac{3}{12}$ *unius recti* ; *atq* ; *P AR & ARP*, *uterq*; $1\frac{8}{12}$ *unius recti* : *Dp cum*

RP alicubi faciet $\frac{1}{12}$ *recti, atq; cum AP* $\frac{7}{12}$ *recti; qui ſimul ſunt* $\frac{8}{12}$ *recti, quantus eſt APR:* (quod verum eſt.) At (inquit) *id fieri non poteſt niſi Dp, RP, concurrant in ipſo P Puncto, ubi concurrunt AP, RP.* Vide Tab. II. Fig. II. Imò, inquam ego, fieri poteſt; ſi (quod res eſt) Dp ſecet R*P* infra P (puta in Q) & poſt occurrat productæ AP ſupra P (puta in O) triangulum formans OPQ; quippe cujus duo anguli interni ad Q & O ($\frac{1}{12}$ recti & $\frac{7}{12}$ recti) ſimul ſumpti æquantur externo oppoſito APR = $\frac{8}{12}$ recti; non minus quàm ſi (quod ille ſomniat) O, P, p, Q, eſſent idem punctum.

Ad *Decimam*; hoc eum malé habet, quòd dixerim, *Non mirandum eſt, Hobbium, his utentem methodis, talem nobis procudere Geometriam; utpote cui circinus eſt Calculo accuratior*: dicitq; *in verbis illis nihil ſe videre in illam ſententiam.* Tu judex eſto, ubi, inter alia, hæc legeris: *Multò probabilius pronunciabit à menſura Menſor diligens, quàm qui pronunciabit à falſis principiis*, (*Logicam ſive Logiſticam* vult, quam modò ut *incertam* condemnaverat; atq; *in cauſa Geometrica non audiendam* toties ingeminat: quod ne dubites, ſic progreditur,) *& Algebriſtam, h. e. Arithmeticum contra Menſuratum diſputantem meritò irridebit.* Aliaq; multa in hunc ſenſum p[illegible]

Quod ſequitur; *Hobbeſius in eo peccatum eſſe putat; putat, inquam, non affirmat*: Nihili eſt; nam ne quidem, ſi *affirmaſſet*, eò magis crederem.

Ad *Undecimam*, (ubi omnia tam miſerè putida fuerant, ut abſtinere digitos ſatius duxerit, quàm particularem vel definitionem vel emendationem aggredi,) ſatis habet inſimulare, *Argumentum à Radicibus non valere, veraſque eſſe* (ſe judice,) quas ego propoſitiones falſas eſſe demonſtraveram. Atque ſimiliter ad controv. *Decimam tertiam* ſeu *Ultimam.*

Ad *Duodecimam*, (ubi multus eſt,) Falſum illud in limine *pag.* 23. l. 1. (unde dependent omnia) *Rectam Dz æqualem eſſe arcui C L.*

Sed porrò *lin.* 29. ait, addito PQL, ubi dicendum erat addito CYP. Quo emendato, non habent reliqua quo nitantur.

Inſuper, *pag.* 24. *l.* 26. hæc habet; *Habemus ergo Æquationem hanc* $2CYP - DPV = DPV - 2PQL$. (eſto. Quid inde?) *Quare, cùm mediæ quantitates, - DPV & DPV ſimul additæ æquales ſint nihilo, 2CYP & 2PQL faciunt nihil. Sunt ergo CYP & PQL trilinea æqualia:* (nempe; æqualium alteri ſi quid addas, quò fiat quantumvis magnum; alteri tantundem demas, quò fiat quantumvis exiguum, aut etiam minus quàm nihil: Tum quid? Num aggregatum illud huic reſiduo erit æquale? aut ulla hinc eorum æqualitas colligenda? Videamus; *Habemus æquationem hanc*; $10 - 8 = 8 - 6$; *quare, cum mediæ quantitates* - 8 *&* 8 *ſimul additæ æquales ſint nihilo*; 10 *&* - 6 *faciunt nihil. Sunt ergo* 10 *&* 6, *item horum dimidia*, 5 & 3, *æqualia.* Sic utiq; vult *Hobbius.*) Putaſne tu, ad hæc Refutatione opus eſſe?

Deinde, (ne ſingulis inſiſtam) *pag.* 25. *l.* 25. *Quoniam ergo,* &c. Uſq; ad *Inter Dk & DZ, &c. l.* 33. ſunt falſa omnia.

Tum illud lin. 35. *DC ad Dk Duplicatam eſſe rationis Dz ad DC,* (quarum, ex conſtructione, altera eſt Majoris, altera Minoris, inæqualitatis ratio: *Hobbium* ſapit.

Item *lin.* 34.&c. *Quoniam ratio DC ad Dz duplicata eſt rationis Dz ad De, erunt*, inquit,(imò, inquam, propterea non erunt) De, Dz, DC, continuè proportionales.

Interim (ut dicta ſua paucis connectam;) *Erit* (inquit. lin. 11.) *Dh, media proportionalis inter DC & Dk*, (Ergò DC, Dh, Dk, continuè proportionales :) Item (lin. 33.) *inter Dk & Dz ſumatur media proportionalis, De*, (Ergo Dz, De, Dk, continué proportionales ; & Dz ad Dk duplicata rationis Dz ad De :)Sed & (lin. 34.)*DC ad Dz eſt Duplicata rationis Dz ad De*; Sunt ergo DC ad Dz,& Dz ad Dk, eadem ratio ; adeòq; D C, Dz, Dk, continuè proporaionales.) Sed & erant (ut jam dictum eſt) DC, Dh, Dk, continuè proportionales) Ergo Dh, Dz, invicem æquales : (quarum illa, per conſtructionem, ponitur media proportionalis ; hæc, duarum mediarum major, inter eaſdem DC, Dk :) Item (propter, tum *De, Dz, DG, continuè proportionales, l.* 34. tum Dk, Dz, DC, continuè proportionales, per jam dicta,) æquales erunt De & Dk (quarum illa, per conſtructionem, & media proportionalis inter hanc & hujus duplam.) Nempe, ſi demonſtrationibus *Hobbianis* ſtandum ſit.

Non mirum itaq;, quód,ad hæc quò viam ſtrueret;(*pag.*24.*l.*37.) *Invalidam* pronunciaverit tum *Demonſtrationem Archimedis*, tum *Euclidis Propoſitionem*, 20. *El.* 6. (Quadratorum rationem duplicatam eſſe rationis Laterum.) *Repugnat enim*, inquit, *non modò longitudini Circumferentiæ Circuli inventæ ab Hobbeſio; ſed etiam prop.* 19. Roſeti, *qua inventæ ſunt duæ mediæ proportionales inter rectam datam & ipſius dimidiam.* Vides itaq, in quo ſtatu ſunt ipſius tum *Quadratura Circuli*, cum *Duplicatio Cubi*, (totúmq; ſimul Roſetum ejus :) & quantâ ſtrage opus eſt, quò ſibi ſternat viam.

Necdum finitum eſt, ſed probatu adhuc opus eſt, (quod & probaturum ſe ſuſcipit, &, ſi qua fides, probaſſe,) *Differentiam inter rectam, & maximam mediarum duarum, inter ſe & ſui ſemiſſem, æqualem eſſe differentiæ inter Mediam, inter duas extremas & Minimam* : (nempe $1 L\sqrt{c}\frac{1}{2} = \sqrt{q}\frac{1}{2} - \frac{1}{2}$.) Sed forti huic opus eſt ventriculo qui hæc concoquat : Meus certé ne devorare quidem potis eſt, nedum concoquere. Fac tu periculum. Ad ea duo præſertim reſpice, (inſpecto ſuo Schemate, quod non tanti eſt ut repetam,) *pag.* 27 *l.* 25. *Sunt ergo Bi, ic, cE, continuè proportionales* ; (nempe, Quia DB. Dc :: Bi. ic ; & Di, DE :: ic. cE. Ergo Bi, ic, cE ∺ ; cùm ne dictum quidem ſit, nedum demonſtratum, DB. DC, & Di, DE, proportionales eſſe.) Et *lin.* 28. *Quare recta DE, dividit angulum BDC beſariam* ; (nempe quia, non Crura DB, DC, ſed aliæ quædam rectæ, AB, AE, ſunt in eadem ratione cum baſis ſegmentis BE, EC.) Quippe ſi hæc duo ferre potes, ſpes eſt, ut Bovem tandem feras, qui Vitulum tuleris.

Ubi hæc peregeris ; ad eas, quæ ſequuntur, *Propoſitiones quinque* cùm veneris ; inſpecto iterum ſuo Schemate, reſpice, num ſpes ſit demonſtrandi, *Rectas omnes à puncto N ductas, & inter AT tranſeuntes, in eadem ratione ſecare arcum BG, & IG ſinum ejus, rectaſque huic parallelas AT, Bq*, &c. De quo ſi non deſpondeas, interritus ad conſpectum monſtri, propiùs admotus, reſpice ad illa *pag.* 29. *l.* 32, &c. ubi, triſecto arcu BG, in f. i, rectâq; AT, in β, X; præſumit, (quoniam probatu erat impoſſibile) Nβf eſſe unam rectam, itémque NXi; quod falſum eſt : quippe recta NF, per β non tranſibit, (adeoq; nec erunt quod ille ſomniat, *Aβ, bf, in ratione NA ad Nb* ; neq; *Nβ producta tranſibit per f.*) ſed neq; *NX producta tranſibit per i,*) (aut Ni, per X.) Et ſimiliter de ſectionum punctis reliquis. Atque hac unâ ſtrage ſimul corruunt hæ *Propoſitiones Quinque* : (Adeoq; nec dabitur : *Recta Arcui Quadrantali æqualis* ; nec *Dividetur Angulus in ratione data* ; nec *Dato Arcui invenietur æqualis recta*; nec *Datæ rectæ æqualis Arcus* ; nec *Inſcribetur Circulo Polygonum Regulare, datum habens numerum Laterum* : Proh dolor !) Nos, quid de hujusmodi nugis ſentiendum ſit, (Rectas omnes, ab uno aliquo puncto ductas, in eiſdem rationibus ſecare poſſe curvam aliquam, atq; expoſitam rectam ; & quæ ſunt hujuſmodi ;) jam olim oſtendimus; non enim vel ſemel, vel nunc primum, ſed olim & ſæpius eâdem oberravit chordâ,) in *Elencho Geometriæ Hobbianæ*, pag. 97, 98, 99 ; 103, 104 ; 111, 112, 113, &c. & *Hobbio Heauton-timor.* p. 119, 120. & alibi.

Tandem (quòd mirum eſt) demonſtrandum ſuſcipit unam Propoſitionem Veram; ſed quam ille mallet Falſam ; quippe id ejus intererat vel maximè:) Nempe, *Quòd quatuor quintæ radii non eſt major duarum mediarum inter radium, & Semi-radium.* Ecquis dixit eſſe ? Certé, ſi non *Hobbius*, nemo alius. Nam $\frac{4}{5}\mathrm{R}=\surd c\,\frac{64}{125}\mathrm{R}^3>\surd c\,\frac{1}{2}\mathrm{R}^3$.) Sed videamus, quàm ille hoc demonſtret Bellé. Nempe hoc ut probet, *pag.* 33, *Eſt* (inquit *lin.* 12.) *Cubus a DC* 1000 *quorum Cubus a Dt eſt* 512. Mox autem (*lin.* 22.) *Cub. DC & Dt, ſive* 512. *&* 256 ; qui neque iidem ſunt neque in eadem ratione, cum 1000 & 512. Paulò pòſt (*lin.* 24. &c.) *Non eſt* (inquit) *rectaDt* (nempe $\frac{4}{5}$ DC) *media proportionalis inter totam DC & ejus dimidiam, ſed eâ major* ; (Recté quidem ; ſed quanto major?) *quantum eſt duodecem milleſimæ partes Cubi à totâ DC* ; (nempe duarum Rectarum differentia, eſt Corpus Solidum;) *ſive quantus eſt Cubus a duabus centeſimis ipſius DC* (pro eodem utique habet, $\frac{12}{1000}$ Cubi, & Cubum ex $\frac{2}{100}$, h. e. $\frac{8}{1000000}$ Cubi : ſed pergit,) *Nam Quadratum à duabus Centeſimis rectæ cujuſcunque, æquale eſt quatuor Centeſimis quadrati totius* ; (Nempe quadratum à $\frac{2}{100}$, ſeu $\frac{4}{10000}$, facit ille $\frac{4}{100}$: (*Et Quadratum diagonalis ejus* (utpote duplum quadrati Lateris) *poteſt* 8 *quorum duæ centeſimæ poteſt* 4. *Itaq; ſuper quadratum ex illis duabus centeſimis ſi conſtruatur Cubus, Cubi iſtius diameter poteſt* 12 *quorum duæ centeſimæ Radii poteſt* 4. (Quorſum hæc ? inquies ; nempe, inquit,) *Demonſtravimus ergo, quatuor quintas ſemidiametri, duarum mediarum inter* Radium *& Semiradium majore, majus eſſe* ; *& quanto.* (Nempe, toto corpore ſolido, quod ſit $\frac{12}{1000}$ Cubi ex Radio ; idemque, ſi credes, æquale Cubo ex $\frac{2}{100}$ Radii.) Spectatum admiſſi riſum teneatis ? Sin hæc placeant, ejuſdem farinæ ſequuntur ibidem plura, modò vacat legere.

Sed eſto. Dabimus enim (utut non ab illo demonſtratum) verum eſſe ; nempe, $\frac{4}{5}$ Radii, *non eſſe majorem duarum mediarum inter Radium & Semi-Radium.* Quid porrò ?

Nempe; cùm non ſint æquales Dt, quæ eſt $\frac{4}{5}$ Radii, & Dz duarum illarum mediarum major, (quod ſe demonſtraſſe putat;) ſuâ tamen interſit ut harum Quadrata ſint æqualia; quorum unius latus *tr*, alterius *zc*; (ſecus enim, ruituram videt totam ſuam machinam, quæ hæc duo quadrata pro eodem habet;) oſtendendum ſuſcipit (pag. 35.) *latitudinem habere* ſuas rectas, & quantam eam eſſe oporteat; tantam ſcil. (ſaltem non minorem) quanta eſt *tz*, (duarum Dt, Dz, differentia;) quò poſſint (parallelæ) *tr*, *ze*, pro eodem ejuſdem quadrati Latere haberi. (Quæ quidem *tz*, major minorve erit prout major minorve eſt expoſitus Radius: Puta ſi ponatur Radius 200 pedes, erit *tz* plusquàm unus pes, ſeu $1\frac{1}{4}$ proximè: ſi Radius 200 milliaria, erit *tz* plusquàm unum milliare. Verùm ſi, (quod ille etiam vult) ſumenda ſit Dc æqualis ipſi DF, erit Dz adhuc minor; ipſaq; *zt* (lineæ latitudo) *milliaria duo* (proximè.) Nam poſito DC $=$ 200, erit $\frac{4}{5}$ ejusdem Dt $=$ 160; & major duarum mediarum Dz $=$ 158 $\frac{3}{4}$ ferè: Sed quam ille deſcripſit Dz, $=$ 158 proximè: Ut ſit (lineæ latitudo) *zt*, partes 2, qualium DC eſt 200; adeóque centeſima pars radii: Quæ itaque non eſt adeò minutula, quid (vel Circino magiſtro) in Schemate non magno diſtingui poſſit, ſi foret *Hobbius* ſaltem *Menſor diligens*. Egregium Commentum, & *Hobbio* dignum! Quod quidem niſi concedamus, (*pag.* 32.*l.*6.) *Sequetur*, inquit, *manifeſtè* (*quoniam longitudo ſine latitudine nihil eſt*;) Latus *quadrati eſſe nihil, h.e. nullum eſſe quadrati latus.* Vid. Tab. II. Fig. III.

Atque hæc ſunt illa, *Hobbeſii Inventa in Geometria* (ſi credes) *multa, nova, excelſa, clara, utilia.* Hæc ea ſunt, propter quæ (utut *verum ſit, nec authoritatem, nec rationem in Mathematicis Hobbeſii, apud Anglos multum valere*;) Extrà, *legitur, intelligitur, laudatur.* Sed ubi terrarum eſt illud *Extra*?) Imò *talia ſunt*, inquit, ut nec ætas prior *majora vidit, nec futura confutabit aut extinguet.* Tu, credo, aliter judicabis.

Ejuſdem

Ejuſdem Doctoris *WALLISII* Non-nulla, De *Centro Gravitatis Hyperbolæ*, Prægreſſæ Epiſtolæ ſubnexa.

T*Andem verò, ne nihil habeas præter* Confutatum Hobbium,*(quæ fortè non tanti res eſt, ut de ea multum ſis ſolicitus;) libet hic annectere*, De Centro Gravitatis Hyperboles *nonnihil*; (*præterito Anno conſcriptum*;) *Miſcellaneis illis, ſi placet, ſubjungendum, quæ habemus ad* Prop. 1. Cap. XV. De Motu. *Nempe*, pag. 753. l. 26. ibidem.

Poſt §. 10. *Hæc addantur.*

11. *Etiam hoc addo.* Spatii Hyperbolici, ſive interioris ſive exterioris, *non quidem ipſum Gravitatis Centrum, ſed Rectam in quâ eſt, ſeu* Axem Æquilibrii exhiberi poſſe, etiamſi ignoretur Plani Magnitudo.

Vid Tab. II Fig. 4. *Eſto enim expoſita Hyperbolæ H h V, Centrum A, axis A X, vertex V, latus rectum* L, *axis tranſverſus* T=2S, *axes intercepti VD*=D, *Vd*=d, *ordinatim-applicatæ HD*=H, *hd*=h, *axis conjugatus A*Δ, *ad quem ordinatim-applicatæ H*Δ=K, *hδ*=k, *aſymptotarum alteri Aσ parallela HS*=B *ad alteram AS*=A *ordinatim-applicetur, & VO ad AO*=E, *& h s ad A s; atq; intelligatur S Aσ angulus rectus; ſitque OS* (=A-E) =O.

Sunt (*propter* $h = \surd : dL + \frac{L}{T}d^2 :$) *ordinatarum ad axem ſemi-quadrata, ſeu momenta reſpectu AD*, $\frac{1}{2}Ld + \frac{L}{2T}d^2$; *&* (*propter* Omn : d, $= \frac{1}{2}D^2$, *&* Omn. $d^2, = \frac{1}{3}D^3$,) *ſimul omnia, ſeu Momentum totius HVD reſpectu AX*, $\frac{1}{4}LD^2 + \frac{L}{6T}D^3$.

Idem (*propter* $k = \surd : S^2 + \frac{T}{L}h^2 :$) *ordinatarum ad axem conjugatum ſemi-quadrata, ſeu momenta reſpectu A*Δ, $\frac{1}{2}S^2 + \frac{T}{2L}h^2$; *&* (*propter* Omn. $h^2, = \frac{1}{3}H^3$,) *ſimul omnia, ſeu totius AVH*Δ, *momentum reſpectu A*Δ, $\frac{1}{2}\text{ſ}^2 H + \frac{T}{6L}H^3$. *Quod ex* (*totius A D H* Δ *momento*) $\frac{1}{2}K^2 H = \frac{1}{2}S^2 H + \frac{T}{2L}H^3$ *ſubductum, relinquit reſidui HVD, reſpectu A*Δ, *momentum* $\frac{T}{3L}H^3$.

Ergo (*propter diſtantias momentis proportionales*,) *in DH, ſumptâ DG, quæ ſit ad AD, ut* $\frac{1}{4}LD^2 + \frac{T}{3L}D^3$ *ad* $\frac{T}{3L}H^3$; *hoc eſt*, $3TL^2D^2 + 2L^2D^3$ *ad* $4T^2H^3$; *erit in* (*junctâ*) *AG, ipſius HVD centrum Gravitatis; utpote cujus puncta ſingula in eâ ratione diſtant ab A D, A* Δ.

Idem obtinebitur ope momenti ipſius HVD reſpectu Aſymptotæ Aσ.

Eſt (*per* § *D* Prop. 31. Cap. 5.) *ipſius OVHS, reſpectu Aσ, momentum* ABO. *Eſt autem Trianguli ASX* ($= \frac{1}{2}A^2$,) *reſpectu ejuſdem Aσ, momentum* $\frac{1}{3}A^3$; *& Trianguli AOV momentum* $\frac{1}{3}E^3$; *poſitiſque HX*(=A−B)=X, *& DB* (*parallelâ AS*) =Y, *adeoque HDX*$=\frac{1}{2}XY$, *hujuſque ab Aσ diſtantiâ centri Gravitatis* $A - \frac{1}{3}Y$, *erit Trianguli HDX, reſpectu Aσ, momentum* $\frac{1}{2}AXY - \frac{1}{6}XY^2$. *Ergo* (*propter HVD*=*ASX*−*AOV*−*OVHS*−*HDX*) *ipſius HVD, reſpectu Aσ, momentum* $\frac{1}{3}A^3 - \frac{1}{3}E^3 - ABO - \frac{1}{2}AXY + \frac{1}{6}XY^2$.

Ergo (propter diſtantias momentis proportionales) in DH, ſumptâ DQ, quæ ſit ad AS, ut $\frac{1}{4}LD^3+\frac{L}{\sigma\Gamma}D^3$ *ad* $\frac{1}{3}A^3-\frac{1}{3}E^3-ABO-\frac{1}{2}AXY+\frac{1}{6}XY^2$; *ductâque QK parallelâ AX occurrente SX in K; erit in (juncta) AK, (utpote cujus ſingula puncta in ea ratione diſtant ab AD, Aσ,) Centrum gravitatis HVD. Quæ quidem AK eſt eadem poſitione recta cum AG; quoniam utraq; tum per A tranſit, tum per Centrum Gravitatis HVD.*

Similiter (ob eandem cauſam,) in ΔH ſumpta ΔL, quæ ſit ad AS, ut $\frac{T}{3L}H^3$ *ad* $\frac{1}{3}A^3-\frac{1}{3}E^3-ABO-\frac{1}{2}AXY+\frac{1}{6}XY^2$; *ductaque LK parallelâ AΔ, occurrente SX in K; erit in (juncta) AK (cujus utique ſingula puncta in ea ratione diſtant ab AΔ, Aσ,) centrum gravitatis HVD. Erit autem hoc K idem quod prius, ob cauſam modò inſinuatam.*

12. *Simili proceſſu utendum in ſpatio exteriori OVHS.*

Eſt enim (ut jam oſtenſum) hujus, reſpectu Aσ, momentum ABO.

Item, reſpectu AX, Trianguli $ASX=\frac{1}{2}A^2$ *eſt (propter centri ab AX diſtantiam* $\frac{1}{3}A\surd\frac{1}{2}$) *momentum* $\frac{1}{6}A^3\surd\frac{1}{2}$; *& ſimiliter, Trianguli AOV, momentum* $\frac{1}{6}E^3\surd\frac{1}{2}$; *Triangulique* $HDX=\frac{1}{2}XY$ *(propter diſtantiam* $\frac{1}{3}$H) *momentum* $\frac{1}{6}XYH$; *ipſiuſque HVD (ut modò)* $\frac{1}{4}LD^2+\frac{L}{6T}D^3$. *Ergo (propter* $OVHS=ASX-AOV-HDX-HVD$,) *ipſius OVHS, reſpectu AX, momentum* $\frac{1}{6}A^3\surd\frac{1}{2}-\frac{1}{6}E^3\surd\frac{1}{2}-\frac{1}{6}XYH-\frac{1}{4}LD^2-\frac{L}{6T}D^3$.

Ergo (propter diſtantias momentis proportionales,) in DH, ſumpta DI, quæ ſit, ad AS, ut $\frac{1}{6}A^3\surd\frac{1}{2}-\frac{1}{6}E^3\surd\frac{1}{3}-\frac{1}{6}XYH-\frac{1}{4}LD^2-\frac{L}{6T}D^3$ *ad ABO: ductaque IF parallelâ AX, occurrente SX in F; erit in (juncta) AF (cujus puncta ſingula in ea ratione diſtant ab AX, Aσ.) centrum gravitatis OVHS.*

Idem obtinebitur comparando ejuſdem OVHS momenta reſpectu Aσ, & AΔ; vel AX, & AΔ; eandem autem AF prodire neceſſe erit, ut quæ tranſire debeat tum per A, tum per ipſius OVHS centrum gravitatis.

13. *Simili item proceſſu utendum eſt in ſpatio exteriori AV*HΔ.

Eſt enim (ut modò) hujus reſpectu AΔ momentum $\frac{1}{2}S^2H+\frac{T}{6L}H^3$.

Idem, reſpectu AX; rectanguli ADHΔ momentum $\frac{1}{2}KH^2$; *unde ſubducto ipſius HVD momento* $\frac{1}{4}LD^2+\frac{L}{6T}D^3$; *habebitur ipſius AVHΔ reſpectu AX momentum* $\frac{1}{2}KH^2-\frac{1}{4}LD^2-\frac{L}{6T}D^3$.

Ergo, in ΔH, ſumpta ΔM, quæ ſit ad DH, ut $\frac{1}{2}S^2H+\frac{T}{6L}H^3$ *ad* $\frac{1}{2}KH^2-\frac{1}{4}LD^2-\frac{L}{6T}D^3$; *erit in (juncta) AM (cujus ſingula puncta in ea ratione diſtant ab AΔ, AX,) centrum gravitatis AVHΔ.*

Idemque obtinebitur comparatis ejuſdem momentis reſpectu AΔ, & Aσ; vel reſpectu AX, & Aσ: eandem autem AM prodire neceſſe erit, ob cauſam ante inſinuatam: Ut non ſit ſpes inde, ob duas ejuſmodi rectas, ſe mutuò decuſſantes, ipſum centrum obtinendi, abſque Plani magnitudine.

Si verò in his omnibus vel non ſit S Aσ ang. rectus; vel Hyperbola, vel Scalena (ſumptâ Diametro quavis aliâ loco Axis AX;) ſimilis adhibenda erit accommodatio cum ea, quam de Scalenis inſinuavimus ad § K prop. 31. c. 5.
Dab. Oxon. Aug. 31. 1672.

An Accompt of ſome Books.

I. *Tractatus de* NATURA SUBSTANTIÆ ENERGETICA, *ſeu de* VITA NATURÆ, *ejuſq; Tribus primis Facultatibus; Perceptiva, Appetitiva, Motiva,* &c. *Auth.* Franc. Gliſſonio, *Med. D, & P. & Coll. Med.* Lond. *Socio, nec non* Societatis Regalis *Collegâ.* Londini. *A.* 1672. *in* 4°.

THe famous Author of this Philoſophical Treatiſe endeavors to make it out, that matter is the Prime and Radical ſubject of *Life*; or, that *Life* is the inmoſt eſſence of matter, and inſeparable from the ſame: And because the very Eſſence of matter is ſubject to various Modifications, that thence its life alſo is capable of being variouſly modified, ſo as to be different in *P*lants and Animals; being in all their kinds varied by a ſtrange diverſity of Structure and Organization.

This Life our Author eſteems to be the very Energetical nature of a ſubſtance, whereby it is fitted for Operation, that is, made a *P*rinciple of Perception, Appetition and Motion; not producible in his opinion by any external power, motion, texture, figure, organization, proportion, or connexion of parts, but by the ſole Firſt Cauſe of all things.

The ſame Life, as 'tis eſſential to matter, is here diſtinguiſh't from the *Senſes*; which to our Author are not the very firſt and ſimple perception of Nature, but ſome Organical Modifications thereof; foraſmuch as, in his opinion, if there were no *Natural* perception, no modification or organization of matter would be able to change it into *Animal* or *Senſitive*; but a Natural one being given, this, flowing immediately from the ſubſtantial nature of the matter, will be ſubject to as many kinds of Modifications, as the matter it ſelf is capable of. And it ſeems, that the main ſcope of this book was, to inveſtigate thoſe various Modifications of life; though the Author ingeniouſly confeſſeth, to have met with ſuch difficulties in this argument, that as yet he hath not ſo much as gone through all the variations of *Inanimat* Subſtances; much leſs through thoſe very ſubtile Formations of *Plants* and *Animals*.

If it be asked, How this *Natural P*erception becomes *Senſitive* or *Animal*; the Doctor anſwers, That diſpoſed matter, finding it ſelf capable, ſo far to raiſe its perceptions, as to redouble it, whereby it may be enabled to judge of its own acts and to behold them with delight, falls upon organizing, and adapts for every Senſe as 'twere a double Organ, an internal and external; and the ſame matter perceiving withal, that 'tis needleſs, there ſhould be an internal one, appropriate for every external, it forms one only internal, Common to all the external, and by proper nerves connects each external to it. And this to him conſtitutes *Senſation*, which he ſaith is not performed without *redoubling* the act of Perception; ſince, if a Nerve, by whoſe means Perception is redoubled, be any way intercepted, as in a *Gutta ſerena*, or in a Paralitick Member, there is no Senſation. So that, according to our Author, Senſation is Perception enobled and exalted, able to judge of its object, to reflect upon it with complacency, to ſuſpend its action, to avert it ſelf from one object to another; whence Brutes themſelves are by him obſerv'd to be in ſome meaſure capable of Diſcipline, and of reward and puniſhment.

From all which it appears, that here is aſſerted ſuch a Natural Perception, as is anterior to, more general, and more ſimple than that of *Senſe*; in which perception, accompanied with appetition and motion, our Author makes Original Life to conſiſt, which to him is nothing elſe but the Energelical nature of any being ſubſiſting by it ſelf, ſince he underſtands not, that ſo noble a being as that is which ſubſiſts by it ſelf, ſhould be uſeleſs, and fit for no operation.

If any do object, that theſe general notions are too ſoon brought upon the Stage, and that *Particular* Forms are to be found out firſt, and thence we are to riſe to the *Univerſal*, foraſmuch as there is nothing in the Underſtanding which has not been firſt in the Senſe; our Author thinks this ratiocination to be grounded upon a falſe ſuppoſition, as if the particular reaſons of things did incurr into our ſenſes before the univerſal.

There are too many things in this Treatiſe for ſuch a Breviat as this muſt be, to take notice of them all. One particular there is, that ſeems very paradoxical; which I ſhall but touch, and then conclude, it is, That this Author judgeth it to be more Philoſophical, to hold a *Penetration of Subſtances* than a *Vacuum*; and that a *Motion* not being to be denied, and conſequently either a *Vacuum*, or ſuch a *Penetration* to be aſſerted, the former of theſe being by him, as he thinks, diſproved, the latter (*Penetration*) muſt take place.

II. Jeremiæ Horroccii *Angli Opera Poſthuma: unà cum* Guil. Crabtræi *Obſervationibus Cœleſtibus ; nec non* Joh. Flamſtedii *de Temporis Æquatione Diatriba, Numeriſq; Lunaribus ad novum* LUNÆ *Syſtema* Horroccii. *Londini, impenſis* Joh. Martyn, *R. Societatis Typographi, A.* 1672. *in* 4°.

THis *Horrox* is the ſame with him, that is the Author of that excellent Tract, called *Venus in Sole viſa*, publiſh't by the famous *Johannes Hevelius* together with his *Mercurius in Sole viſus:* who if he had not been ſnatch't away by an untimely death in the flower of his age, would certainly, by his induſtry and exactneſs, which did accompany his great affection to Aſtronomy, have very conſiderably advanced that Science. Now we have only left us theſe imperfect Papers, digeſted, not without great care and labour, by that Learned Mathematician Dr. *John Wallis ;* Wherein does occurr,

Firſt, the *Keplerian* Aſtronomy, aſſerted and promoted ; which this Author undertook, after he had ſpent much time, and taken great pains in acquainting himſelf with that of *Lanſbergius*, which he at firſt embraced with ſo much eagerneſs and addition, that it was difficult to divorce him from it ; till at length, by the advertiſements of *William Crabtree*, a ſagacious and diligent Aſtronomer of that time, he found, that neither the *Hypotheſes* of *Lanſbergius* were conſiſtent among themſelves, nor his *Tables* agreed with Obſervations exactly made, nor the Precepts of them were well demonſtrated or could be ; whatever that man boaſted of the wonderfull agreement of his *Tables* with the Obſervations of former times: All which errors having been found at laſt by our Author himſelf, and withall the writings of *Kepler*, and the *Rudolphin Tables* by him ſearch't into, he ſaw cauſe far to prefer them to the *Lansbergian*, becauſe grounded upon *Hypotheſes* conſonant to Nature, and well agreeing with the Heavens: though he found cauſe by his accurate Obſervations to amend even theſe Tables ; yet without a neceſſity of changing the *Hypotheſis*. In which work when he was well engaged, he was cut off by death very young, in the 23th year of his age. His firſt piece then, were his Diſputations againſt the Aſtronomy of *Lanſbergius*, in which he clearly demonſtrates, that the *Hypotheſes* of that Author do neither agree with the Heavens nor among themſelves. Which argument he carried on ſo far, that having finiſh't the *four* firſt

Diſputations(as they are here to be found)he had begun a few ſheets of the *fifth*, which was about the Diagram of *Hipparchus*,from which ſome have pretended exactly to demonſtrate the Diſtance of the Sun. After which follow two Diſputations more; the *one*, of the Celeſtial bodies and their Motion; the *other*, his Anſwer to the Cavils of *Hortenſius* againſt *Tycho*. So much of the *Firſt* part of this Volume.

The *ſecond* contains a good number of *Extracts* out of this Authors Letters to his intimate friend and induſtrious companion in the Study of Aſtronomy, *William Crabtree*. In which occurr many good Celeſtial Obſervations, interlaced with divers notable diſcourſes concerning the Method of his ſtudies.

The *third*, is a Catalogue of Aſtronomical Obſervations, as they were made by our Author, without allowance for the Excentricity of the Eye; which he afterwards caſtigated by a correction fairly written with his own hand.

The *fourth*, is his *New* Theory of the Moon, together with the *Lunar Numbers* of Mr. *Flamſtead* upon it.

To theſe are annexed, *firſt* the Celeſtial Obſervations of *William Crabtree*, concerning *Saturn*, *Jupiter*, *Mars* and *Venus* ; and *then*, Mr.*Flamſteeds* Diſſertation of the *Inequality* of Solar days; wherein are demonſtrated the *Proſthaphæreſes* of the time, neceſſary to make an Equation,and proceeding from the Unequal motion of the Earth from the *Aphelion* to the *Perihelion*,and the Inclination from the *Equinoxes* to the *Solſtices*, and *vice verſa*.

III. Marcelli Malpighii P*hil.* & *Medici Bononienſis Diſſertatio Epiſtolica de* Formatione Pulli in Ovo:*Londini apud* Joh. Martyn *Soc. Reg. Typographum, ad inſigne Campanæ in Cæmeterio S. Pauli*, 1672. *in* 4°.

THis excellent Philoſopher and Accurate Anatomiſt, a very Induſtrious and uſeful Member of the *R. Society*,having in a *Manuſcript* preſented that Illuſtrious body with his Obſervations upon the Formation of a Chick in an Egg as well *before* as *after* Incubation ; and that Company having eſteemed them very worthy the Preſs,as well to do the Author right, as to give occaſion to others to inquire further into a matter ſo conducive for finding out the nature of Generation : We ſhall here give ſome accompt of this well-conſider'd diſcourſe; after we have intimated, that an Engliſh Phyſitian, a worthy

Member alſo of the ſaid Society,(Dr. *William Croon*,) hath likewiſe, by a curious examination of Eggs not yet incubated, very happily found, in conformity to the diſcovery of Signor *Malpighi*, the Rudiments of a Chick actually exiſtent in the Egg even *before* incubation: Of which he produced a written diſcourſe before the ſaid Society *March* 14. 1671; which he affirmed to have been written a good while before, and which was read in part *March* 28. 1672. at the publick Meeting of the ſaid Society: who do hope, that the ſaid *Doctor* will make no difficulty, for confirmation and further excitement, to communicate alſo to the publick his learned Obſervations upon this ſubject. Which being thus premiſ'd, we ſhall now proceed briefly to take notice, that this Exercitation of Signor *Malpighi*, which came to the *R. Society*, *Feb.* 22. $16\frac{71}{72}$, contains an accompt of his having, by carefull and diligent Obſervations, diſcover'd, that in *ſecond* Eggs, as well *before* as *after* incubation, the firſt Rudiments and Lines of the principal parts of the Chick are contained in the Eggs; whereas in *Subventaneous* or *Adle* Eggs, inſtead of ſuch a formation, there is found nothing but an un-form'd globous aſh-coloured body, like a *mola*. Of theſe *prima ſtamina* or beginnings, this Author hath traced the progreſs, by obſerving their changes, after incubation, every ſix hours, for the two firſt days; and, after that, every 12 or 24, or 48 hours. In the doing of which, he hath obſerv'd many very curious and remarkable particulars, eſpecially about the Priority of the Motion of the Heart *before* the production of *true* blood, though that liquor, before it becomes red, be, according to him, *before* the motion of the heart; as alſo about the ſaid liquor firſt emerging, *viz.* whether it be a ſimple *colliquamentum*, or a *liquor vitalis*, or a *ſanguis inchoatus*: concerning which he aſſerts, that the *Carina*, and the beginnings of the head, brain, and Spinal Marrow, do manifeſtly appear *before* the Collection of that Liquor, and its motion, and change into the nature of Blood: For which, and many other conſiderable particulars, ſince they cannot be treated in ſuch an abſtract as this without prejudicing the whole, we are obliged to remit the Reader to the intire diſcourſe it ſelf.

IV. *De MENTE HUMANA Libri quatuor &c. Auth.* J.B. du Hamel *P. S. L.* Pari*ſiis A.* 1672. *in* 12.

THe Learned Author of this Book treats in it of the Nature, Powers, Functions, and Immortality of the ſoul; delivering withal a ſolid Logick, illuſtrated by various and inſtructive experiments. This he doth in *four* parts;

In the *firſt* he inquireth into the nature, origine and progreſs of knowledge in general, and of *ſimple Perception* in particular; obſerving the chief defects of perceptions, together with their remedies, Attention, and Conſideration, much helped by the ſtudy of the Mathematicks, and by Receſs, &c.

In the *ſecond* he treats, after the ſame method, of the *Judgment* of the Mind, the height and perfection of humane knowledge. Where he diſcourſes largely of the *Criterium* and Mark of Truth, conſiſting principally in the clearneſs and diſtinctneſs of Perception, as that, whereby the mind *knows* the congruity of its knowledge with the thing known. Here he taketh occaſion to examine *Pyrrhoniſme* or *Scepticiſme*, profeſſed by a Sect of men that ſpeak otherwiſe than they think. Which done, he endeavours to ſhew not only, whence the Light and Evidence of Principles flows, namely from Eternal and Immutable Reaſons and *Idea's*, forming and directing our knowledge, and begetting a certain and firm judgment in us; but alſo, how we ſhall come to ſee thoſe Eternal reaſons or that Intrinſick Light of Truth. To all which he annexeth thoſe Propoſitions, that are, in his judgment, to be eſteemed for Principles and Axioms ſo evident, that their Truth ſhineth forth by themſelves, and needs no demonſtration: Concluding this part with a conſiderable Enumeration *both* of the principal Cauſes of Errors, (which may be reſolv'd into that main one, the *Confuſion of Perceptions*, breeding either a haſty and unadviſed, or a falſe judgment,) and of the Remedies of the ſame.

In the *Third*, he treats of *Argumentation* and its nature and origine; of Syllogiſmes and *P*aralogiſmes; and eſpecially of the true way of Demonſtrating; which latter he ſo performs, that little ſeems to be by him omitted of what hath been written by others that is conſiderable. And leaſt a naked and jejune delivery of Rules ſhould prove tedious to the Reader, he hath made them grateful with abundance of uncommon and pleaſing examples; and laboured, not only in a Logical but *P*hyſiological way to explain the cauſe, nature, windings and errors of Ratiocination. Beſides, his purpoſe being to deliver a *Logick*, ſutable not only to the old Scholaſtick, but alſo to the Modern and Experimental *P*hiloſophy; he diſcourſeth copiouſly and inſtructively of *Induction*; ſhewing from the Excellent Lord of *Verulam*, and the Illuſtrious *Robert Boyle*, how Natural *P*hiloſophy and all uſeful Arts may be improv'd and advanced by the hitherto too much neglected induction. Where he takes occaſion to ſpeak of and commend that way of finding out the *Efficient* cauſes of things, call'd by the newly mention'd Lord *Inſtantia Crucis*, becauſe, like a Croſs erected where more ways than one do meet, it ſhews which of them you are to take. Which, among others, he illuſtrates by the example concerning the Queſtion of the *Cauſe of Gravity. viz.* Whether it be a Quality inherent in bodies, or the Magnetical power of the Earth, or the Circum-ambient Air or Æther? Alledging for this purpoſe an Experiment, ſeeming to him to be ſuch a determining inſtance as hath been ſpoken of; made by Monſieur *Hugens* before the Royal Academy at *Paris*, and related at large by Monſ. *Rohault* in his *Traite de Phyſique*, printed at *Paris A.* 1671. *part* 2. *ch.* 28. *p.* 122. to which we refer the Reader; haſtning to

The Fourth and laſt part of this Book, which conſiders the Powers, Nature, and Immortality of the Rational Soul, and is ſollicitouſly employ'd in ſolving many difficulties occurring about this matter: Which being a ſubject not ſo proper to the deſign of theſe Tracts, we ſhall here forbear to enlarge upon.

V. A Letter of *Francesco Redi* concerning ſome Objections made upon his Obſervations about *Vipers*; together with a Reply to that Letter by *Moyſe Charas*: Now both Printed in *Engliſh*, for *John Martyn*. Printer to the R. Society, at the *Bell* in St. *Pauls Church yard*, 1672. in 8o; and formerly deſcribed in theſe *Tracts*, viz. *Numb.* 66. *p* 2036. and *Numb.* 83. p. 4073.

VI. De *Gemmarum Origine* & *Viribus* Exercitatio: Auth. *Roberto Boyle*, Nobili Anglo. This Tract was alſo formerly, when it firſt came abroad in *Engliſh*, deſcribed, viz. in *Numb.* 84. *p.* 4095. and is now mention'd again, only to give notice to Forrainers, that 'tis printed in *Latin* for the ſame Bookſeller, for whom was printed the Engliſh Edition.

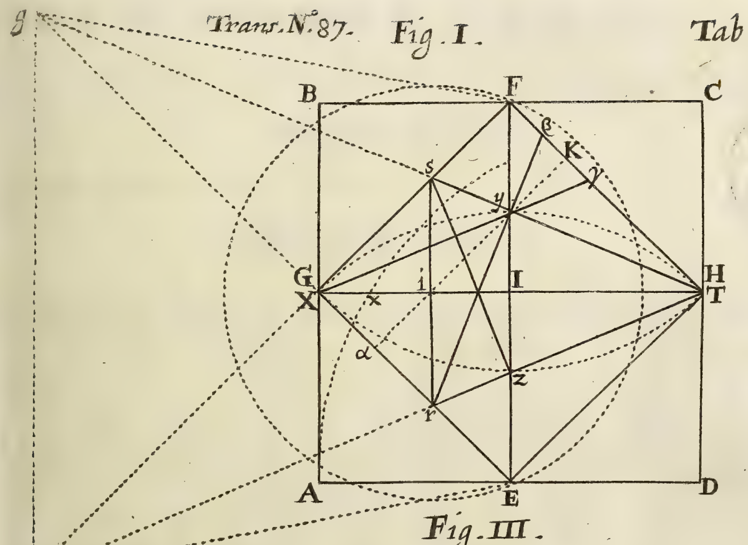
Errata in this Tract.

Pag. 5053. l. 19. r. *in its priſtine.* p. 5055. l. 26. r. *vehicle.*

LONDON,

Printed for John Martyn, *Printer to the Royal Society*, 1672.

Trans. N°. 87. Fig. I. Tab. II. Fig. II.



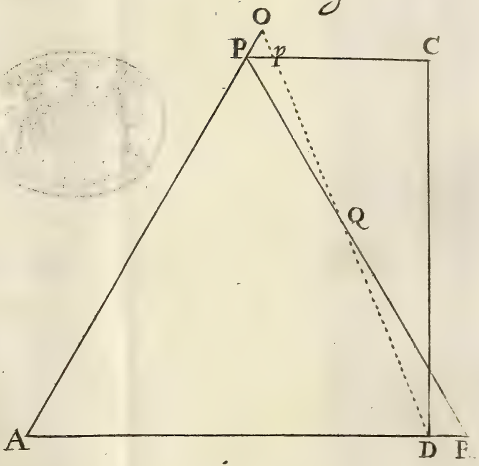


Fig. III.

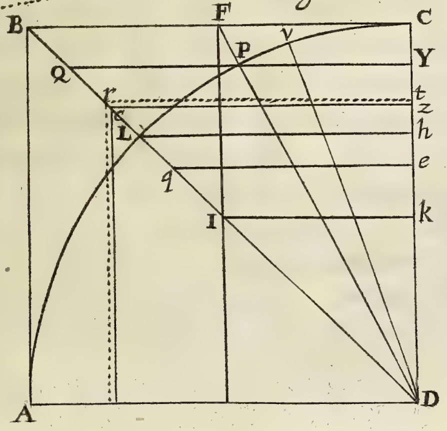
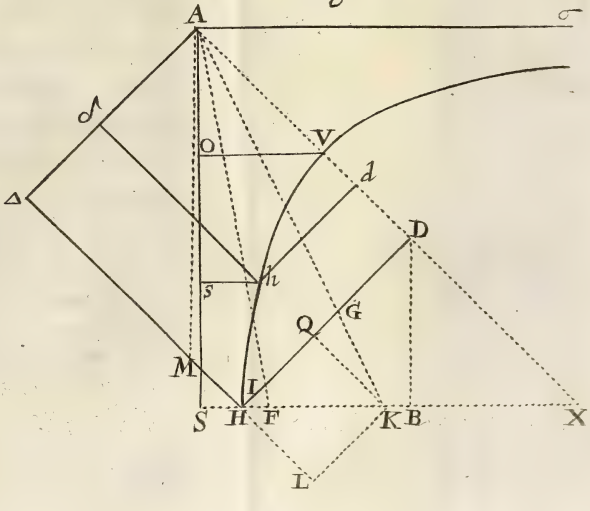


Fig. IV.



TISH MUSEUM
URAL HISTORY.

Numb. 88.

PHILOSOPHICAL TRANSACTIONS.

November 18. 1672.

The CONTENTS.

Mr. Iſaac Newtons *Anſwer to ſome Conſiderations upon his Doctrine of Light and Colors, as it was Printed in* Numb. 80. *of theſe Tracts: In which Anſwer ſome things being premiſed about both the Practique and Theorique part of Opticks; the Author endeavours to make it out,* that *he aſſumes no* Hypotheſis *for his Doctrine;* that *the Examiners and all other Mechanical* Hypotheſes *in their genuine conſtitution are conformable to his Doctrine;* and that *it is not neceſſary to limit or explain his Doctrine by any* Hypotheſis. *To which is added a Reſolution of three important* Quære's, 1. *Whether the Unequal Refractions, made without reſpect to any inequality of incidence, be cauſed by the different Refrangibility of ſeveral rays; or by the Splitting, Breaking or Diſſipating the ſame Ray into diverging parts?* 2. *Whether there be more than two Original colours?* 3. *Whether Whiteneſs be a mixture of all Colors? Some particulars of this ſubject recommended to further Conſideration. An Accompt of two Books:* I. *Othonis de Gericke EXPERIMENTA MAGDEBURGICA NOVA,* II. *Theſaurus MEDICINÆ PRACTICÆ, Studio & operâ* Thomæ Burnet. *M D.* &c.

Mr. Iſaac Newtons *Anſwer to ſome Conſiderations upon his Doctrine of* Light *and* Colors; *which Doctrine was printed in* Numb. 80. *of theſe Tracts.*

SIR, I have already told you, that at the peruſal of the conſiderations, you ſent me, on my Letter concerning *Refractions* and *Colors*, I found nothing, that, as I conceived, might not without difficulty be anſwer'd. And though I find the *Conſiderer* ſomewhat more concern'd for an *Hypotheſis*, than I expected; yet I doubt not, but we have one common deſign; I mean, a ſincere endeavour after knowledge, without valuing uncertain ſpeculations for their ſubtleties, or deſpiſing certainties for their plainneſs: And on confidence of this it is, that I make this return to his diſcourſe.*

1. *Of the Practique part of Optiques.*

The *firſt* thing that offers it ſelf is leſs agreeable to me, and I begin with it becauſe it is ſo. The conſiderer is pleaſed to reprehend me for laying aſide the thoughts of improving Optiques by *Refractions*. If he had obliged me by a private Letter on this occaſion, I would have acquainted him with my ſucceſſes on the Tryals I have made of that kind, which I ſhall now ſay have been leſs than I ſometimes expected, and perhaps than he at preſent hopes for. But ſince he is pleaſed to take it for granted, that I have let this ſubject paſs without due examination, I ſhall refer him to my former Letter, * by which that conjecture will appear to be un-grounded. For, what I ſaid there, was in reſpect of Teleſcopes of the ordinary conſtruction, ſignifying, that their improvement is not to be expected from the *well-figuring* of Glaſſes, as Opticians have imagin'd; but I deſpaired not of their improvement by other conſtructions; which made me cautious to inſert nothing that might intimate the contrary. For, although ſucceſſive refractions that are all made the ſame way, do neceſſarily more and more augment the errors of the firſt refraction; yet it ſeem'd not impoſſible for *contrary* refractions ſo to correct each others inequalities, as to make their difference regular; and, if that could be conveniently effected, there would be no further difficulty. Now to this end I examin'd, what may be done not only by *Glaſſes alone*, but more eſpecially by a Complication of divers ſucceſſive *Mediums*, as by two or more Glaſſes or Cryſtals with Water or ſome other fluid between them; all which together may perform the office of *one Glaſs*, eſpecially of the Object-glaſs, on whoſe conſtruction the perfection of the inſtrument chiefly depends. But what the reſults in Theory or by Tryals have been, I may poſſibly find a more proper occaſion to declare.

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* *Which* Diſcourſe *was thought needleſs to be here printed at length, becauſe in the body of this Anſwer are to be met with the chief particulars, wherein the* Anſwerer *was concern'd.*

* *Printed in* Numb. 80. *of theſe Tracts.*

To the Aſſertion, that Rays are leſs true *reflected* to a point by a *Concave*, than *refracted* by a Convex, I cannot aſſent; nor do I underſtand, that the *focus* of the latter is leſs a line than that of the former. The truth of the contrary you will rather perceive by this following Table, computed for ſuch a *Reflecting Concave*, and *Refracting convex*, on ſuppoſition that they have equal Apertures, and collect parallel rays at an equal diſtance from their *vertex*; which diſtance being divided into 15000 parts, the Diameter of the Concave Sphere will be 60000 of thoſe parts, and of the Convex, 10000; ſuppoſing the *Sines* of Incidence and Refraction to be, in round numbers, as 2 to 3. And this Table ſhews, how much the exterior rays, at ſeveral Apertures, fall ſhort of their principal *focus*.

The Diameter of the Aperture.	*The parts of the Axis intercepted between the* vertex *and the rays.*		*The Error by*	
	Reflected.	*Refracted.*	*Reflexion.*	*Refraction.*
2000	$14991\frac{2}{3}$	14865	$8\frac{1}{3}$	135.
4000	14966	14449	33	551.
6000	14924	13699	76	1301.
8000	14865	12475	135	2525.
10000	14787	9472	213	5528.

By this you may perceive, that the Errors of the *Refracting convex* are ſo far from being *leſs*, that they are more than ſixteen times greater than the like errors of the *Reflecting Concave*, eſpecially in great Apertures; and that without reſpect to the Heterogeneous conſtitution of light. So that, however the contrary ſuppoſition might make the Author of theſe Animadverſions reject *Reflections* as uſeleſs for the promoting of Optiques ; yet I muſt for this as well as other conſiderations prefer them in the Theory before *Refractions*.

Whether the *Parabola* be more difficult to deſcribe than the *Hyperbola* or *Ellipſis*, may be a *Quære* : But I ſee no abſolute neceſſity of endeavouring after any of their deſcriptions. For, if Metals can be ground truly Spherical, they will bear as great Apertures, as I believe men will be well able to communicate an *exact* poliſh to. And for Dioptrique Teleſcopes, I told you, that the difficulty conſiſted not in the Figure of the glaſs, but in the Difformity of Refractions : Which if it did not, I could tell you a better and more eaſie remedy than the uſe of the *Conic Sections*.

2. Of the Theorique part.

Thus much concerning the *Practique* part of Optiques. I ſhall now take a view of the Conſiderations on my *Theories*. And thoſe conſiſt in aſcribing an *Hypotheſis* to me, which is not mine; in Aſſerting an *Hypotheſis*, which, as to the principal parts, is not againſt me ; in Granting the greateſt part of my diſcourſe if explicated by that *Hypotheſis* ; and in Denying ſome things, the truth of which would have appear'd by an experimental examination.

3. Of an Hypotheſis miſtaken to be mine.

Of theſe Particulars I ſhall diſcourſe in order. And firſt of the *Hypotheſis*, which is aſcribed to me in theſe words : *But grant his firſt ſuppoſition, that light is a body, and that as many colours or degrees as there may be, ſo many bodies there may be ; all which compounded together would make White*, &c. This, it ſeems, is taken for my *Hypotheſis*. 'Tis true, that from my Theory I argue the *Corporeity* of Light ; but I do it without any abſolute poſitiveneſs, as the word *perhaps* intimates~~; and~~ make it at moſt but a very plauſible *conſequence* of the Doctrine, and not a fundamental *Suppoſition*, nor ſo much as any part of it ; which was wholly comprehended in the precedent Propoſitions. And I ſomewhat wonder, how the *Objector* could imagine, that, when I had aſſerted the Theory with the greateſt rigour, I ſhould be ſo forgetful as afterwards to aſſert the fundamental ſuppoſition it ſelf with no more than a *perhaps*. Had I intended any ſuch *Hypotheſis*, I ſhould ſomewhere have explain'd it. But I knew, that the *Properties*, which I declar'd of *Light*, were in ſome meaſure capable of being explicated not only by that, but by many other Mechanical *Hypotheſes*. And therefore I choſe to decline them all, and to ſpeak of ***Light*** in ***general*** terms, conſidering it abſtractly, as ſomething or other propagated every way in ſtreight lines from luminous bodies, without determining, what that Thing is; whether a confuſed Mixture of difform qualities, or Modes of bodies, or of Bodies themſelves, or of any Virtues, Powers, or Beings whatſoever. And for the ſame reaſon I choſe to ſpeak of ***Colours*** according to the information of our Senſes, as if they were Qualities of Light *without* us. Whereas by that *Hypotheſis* I muſt have conſidered them rather as *Modes* of Senſation, excited in the mind by various motions, figures, or ſizes of the corpuſcles of Light, making various Mechanical impreſſions on the Organ of Senſe; as I expreſſed it in that place, where I ſpake of the Corporeity of Light.

But ſuppoſing I had propounded that *Hypotheſis*, I underſtand not, why the Objector ſhould ſo much endeavour to oppoſe it. For certainly it has a much greater affinity with his own *Hypotheſis*, than he ſeems to be aware of; the Vibrations of the *Æther* being as uſeful and neceſſary in *this*, as in *his*. For, aſſuming the Rays of Light to be ſmall bodies, emitted every way from Shining ſubſtances, thoſe, when they impinge on any Refracting or Reflecting ſuperficies, muſt as neceſſarily excite Vibrations in the *æther*, as Stones do in water when thrown into it. And ſuppoſing theſe Vibrations to be of ſeveral depths or thickneſſes, accordingly as they are excited by the ſaid corpuſcular rays of various ſizes and velocities; of what uſe they will be for explicating the manner of Reflection and Refraction, the production of Heat by the Sun-beams, the Emiſſion of Light from burning putrifying, or other ſubſtances, whoſe parts are vehemently agitated, the *Phænomena* of thin tranſparent Plates and Bubles, and of all Natural bodies, the Manner of Viſion, and the Difference of Colors, as alſo their Harmony and Diſcord; *I* ſhall leave to their conſideration, who may think it worth their endeavor to apply this *Hypotheſis* to the ſolution of *phænomena*.

In

4. Of the Objector's Hypotheſis, *and that the moſt free and genuine Conſtitution of that and all other Mechanical Hypotheſes is conformable to my* Doctrine.

In the ſecond place, I told you, that the Objectors *Hypotheſis*, as to the fundamental part of it, is not againſt me. That fundamental Suppoſition is: *That the parts of bodies, when briskly agitated, do excite Vibrations in the Æther, which are propagated every way from thoſe bodies in ſtreight lines, and cauſe a Senſation of Light by beating and daſhing againſt the bottom of the Eye, ſomething after the manner that Vibrations in the Air cauſe a Senſation of Sound by beating againſt the Organs of Hearing.* Now, the moſt free and natural Application of this *Hypotheſis* to the Solution of *phænomena* I take to be this: *That* the agitated parts of bodies, according to their ſeveral ſizes, figures, and motions, do excite Vibrations in the *æther* of various depths or bigneſſes, which being promiſcuouſly propagated through that *Medium* to our Eyes, effect in us a Senſation of Light of a *White* colour; but if by any means thoſe of unequal bigneſſes be ſeparated from one another, the largeſt beget a Senſation of a *Red* colour, the leaſt or ſhorteſt, of a deep *Violet*, and the intermediat ones, of intermediat colors; much after the manner that bodies, according to their ſeveral ſizes, ſhapes, and motions, excite vibrations in the Air of various bigneſſes, which, according to thoſe bigneſſes, make ſeveral Tones in Sound: *That* the largeſt Vibrations are beſt able to overcome the reſiſtance of a Refracting ſuperficies, and ſo break through it with leaſt Refraction; whence the Vibrations of ſeveral bigneſſes, that is, the Rays of ſeveral Colors, which are blended together in Light, muſt be parted from one another by Refraction, and ſo cauſe the *Phænomena* of *Priſmes* and other refracting ſubſtances: And *that* it depends on the thickneſs of a thin tranſparent Plate or Buble, whether a Vibration ſhall be *reflected* at its further ſuperficies, or *tranſmitted*; ſo that, according to the number of vibrations, interceding the two ſuperficies, they may be reflected or tranſmitted for many ſucceſſive thickneſſes. And ſince the Vibrations which make B*lew* and *Violet*, are ſuppoſed ſhorter than thoſe which make *Red* and *Yellow*, they muſt be reflected at a leſs thickneſs of the Plate: Which is ſufficient to explicate all the ordinary *phænomena* of thoſe Plates or Bubles, and alſo of all natural bodies, whoſe parts are like ſo many fragments of ſuch Plates.

Theſe ſeem to be the moſt plain, genuine and neceſſary conditions of this *Hypotheſis*: And they agree ſo juſtly with my Theory, that if the *Animadverſor* think fit to apply them, he need not, on that account, apprehend a divorce from it. But yet how he will defend it from other difficulties, I know not. For, to me, the Fundamental Suppoſition it ſelf ſeems impoſſible; namely, That the *Waves* or Vibrations of any Fluid, can, like the Rays of Light, be propagated in *Streight* lines, without a continual and very extravagant ſpreading and bending every way into the quieſcent Medium, where they are terminated by it. I miſtake, if there be not both Experiment and Demonſtration to the contrary. And as to the other two or three *Hypotheſes*, which he mentions, I had rather believe them ſubject to the like difficulties, than ſuſpect the *Animadverſor* ſhould ſelect the worſt for his own.

What I have ſaid of this, may be eaſily applied to all other *Mechanical Hypotheſes*, in which Light is ſuppoſed to be cauſed by any Preſſion or Motion whatſoever, excited in the *æther* by the agitated parts of Luminous bodies. For, it ſeems impoſſible, that any of thoſe Motions or Preſſions can be propagated in *Streight* lines without the like ſpreading every way into the ſhadow'd Medium, on which they border. But yet, if any man can think it poſſible, he muſt at leaſt allow, that thoſe Motions or Endeavors to motion, cauſed in the *æther* by the ſeveral parts of any Lucid body that differ in ſize, figure, and agitation, muſt neceſſarily be unequal: Which is enough to denominate Light an Aggregat of *difform* rays, according to any of thoſe Hypotheſes. And if thoſe Original inequalities may ſuffice to difference the Rays in Colour and Refrangibility, I ſee no reaſon, why they, that adhere to any of thoſe *hypotheſes*, ſhould ſeek for other Cauſes of theſe Effects, unleſs (to uſe the *Objectors* argument) they will multiply entities without neceſſity.

The *third* thing to be conſidered is, the Condition of the *Animadverſor's* Conceſſions, which is, that I would explicate my *Theories* by his *Hypotheſis*: And if I could comply with him in that point,

5. *Of the* Animadverſor's *Conceſſions, and their limitation to his Hypotheſis.*

there would be little or no difference between Us. For he grants, that without any reſpect to a different Incidence of rays there are different Refractions; but he would have it explicated, not by the different Refrangibility of ſeveral Rays, but by the Splitting and Rareſying of æthereal pulſes. He grants my *third*, *fourth* and *ſixth* Propoſitions; the ſenſe of which is, That Un-compounded Colors are unchangeable, and that Compounded ones are changeable only by reſolving them into the colors, of which they are compounded; and that all the Changes, which can be wrought in Colours, are effected only by variouſly mixing or parting them: But he grants them on condition that I will explicate Colors by the two ſides of a ſplit pulſe, and ſo make but two *ſpecies* of them, accounting all other Colors in the world to be but various degrees and dilutings of thoſe two. And he further grants, that *Whiteneſſe* is produced by the Convention of all Colors; but then I muſt allow it to be not only by Mixture of thoſe Colors, but by a farther Uniting of the parts of the Ray ſuppoſed to be formerly ſplit.

If I would proceed to examine theſe his Explications, I think it would be no difficult matter to ſhew, that they are not only *inſufficient*, but in ſome reſpects to me (at leaſt) *un-intelligible*. For, though it be eaſie to conceive, how *Motion* may be dilated and ſpread, or how parallel motions may become diverging; yet I underſtand not, by what artifice any *Linear* motion can by a refracting ſuperficies be *infinitely* dilated and rarefied, ſo as to become *Superficial*: Or, if that be ſuppoſed, yet I underſtand as little, why it ſhould be ſplit at ſo ſmall an angle only, and not rather ſpread and diſperſed through the whole angle of Refraction. And further, though I can eaſily imagine, how Unlike motions may croſs one another; yet I cannot well conceive, how they ſhould coaleſce into one *uniform* motion, and then part again, and recover their former Unlikeneſs; notwithſtanding that I conjecture the ways, by which the *Animadverſor* may endeavour to explain it. So that the Direct, uniform and undiſturbed Pulſes ſhould be ſplit and diſturbed by Refraction; and yet the Oblique and diſturbed Pulſes perſiſt without ſplitting or further diſturbance by following Refractions, is (to me) as unintelligible. And there is as great a difficulty in the Number of Colours; as you will ſee hereafter.

6. *That it is not neceſſary, to limit or explain my Doctrine by any* Hypotheſis.

But whatever be the advantages or diſadvantages of this *Hypotheſis*, I hope I may be excuſed from taking it up, ſince I do not think it needful to explicate my Doctrine by any *Hypotheſis* at all. For if *Light* be conſider'd abſtractedly without reſpect to any *Hypotheſis*, I can *as* eaſily conceive, that the ſeveral parts of a ſhining body may emit rays of differing colours and other qualities, of all which Light is conſtituted, *as* that the ſeveral parts of a falſe or uneven ſtring, or of uneavenly agitated water in a Brook or Cataract, or the ſeveral Pipes of an Organ inſpired all at once, or all the variety of Sounding bodies in the world together, ſhould produce ſounds of ſeveral Tones, and propagate them through the Air confuſedly intermixt. And, if there were any natural bodies that could *reflect* ſounds of one tone, and ſtifle or *tranſmit* thoſe of another; then, as the *Echo* of a confuſed Aggregat of all Tones would be that particular Tone, which the Echoing body is diſpoſed to reflect; ſo, ſince (even by the *Animadverſor's* conceſſions) there are bodies apt to *reflect* rays of one colour, and ſtifle or *tranſmit* thoſe of another; I can as eaſily conceive, that thoſe bodies, when illuminated by a mixture of all colours, muſt appear of that colour only which they reflect.

But when the *Objector* would inſinuate a difficulty in theſe things, by alluding to Sounds in the ſtring of a Muſical inſtrument before percuſſion, or in the Air of an Organ Bellowes before its arrival at the Pipes; I muſt confeſs, I underſtand it as little, as if one had ſpoken of Light in a piece of Wood before it be ſet on fire, or in the oyl of a Lamp before it aſcend up the match to feed the flame.

7. *The difficulties of the* Animadverſors *diſcourſe abſtracted from* Hypotheſes, *and conſider'd more generally.*

You ſee therefore, how much it is beſides the buſineſs in hand, to diſpute about *Hypotheſes*. For which reaſon I ſhall now in the laſt place, proceed to abſtract the difficulties in the *Animadverſor's* diſcourſe, and, without having regard to any *Hypotheſis*, conſider them in general terms. And they may be reduced to theſe 3 *Queres*:

1. Whether the unequal Refractions, made without reſpect to any inequality of incidence, be cauſed by the different Refrangibility of ſeveral Rays; or by the ſplitting, breaking or diſſipating the ſame Ray into diverging parts?

2. Whether there be more than two ſorts of Colours?

3. Whether Whiteneſs be a mixture of all Colours?

8. *That the Ray is not ſplit, or any otherwiſe dilated.*

The *Firſt* of theſe *Quæres* you may find already determin'd by an Experiment in my former Letter; the deſign of which was to ſhew, That the length of the colour'd Image proceeded not from any unevenneſs in the Glaſs, or any other *contingent* Irregularity in the Refractions. Amongſt other Irregularities I know not, what is more obvious to ſuſpect, than a fortuitous dilating and ſpreading of Light after ſome ſuch manner, as *Des-Cartes* hath deſcribed in his Æthereal Refractions for explicating the *Tayle* of a *Comet*; or as the *Animadverſor* now ſuppoſes to be effected by the Splitting and Rarifying of his Æthereal ſpulſes. And to prevent the ſuſpicion of any ſuch Irregularities, I told you, that I refracted the Light contrary ways with two Priſmes ſucceſſively, to deſtroy thereby the *Regular* effects of the *firſt* Priſme by the *ſecond*, and to diſcover the *Irregular* effects by augmenting them with iterated refractions. Now, amongſt other Irregularities, if the *firſt* Priſme had ſpread and diſſipated every ray into an indefinit number of diverging parts, the *ſecond* ſhould in like manner have ſpread and diſſipated every one of thoſe parts into a further indefinite number, whereby the Image would have been ſtill more dilated, contrary to the event. And this ought to have hapned, becauſe thoſe Linear diverging parts depend not on one another for the manner of their Refraction, but are every one of them as truly and compleatly Rays as the whole was before its Incidence; as may appear by intercepting them ſeverally.

The reaſonableneſs of this proceeding will perhaps better appear by acquainting you with this further circumſtance. I ſometimes placed the *ſecond* Priſme in a poſition Tranſverſe to the *firſt*, on deſign to try, if it would make the long Image become four-ſquare by refractions croſſing thoſe that had drawn the round Image into a long one. For, if amongſt other Irregularities the Refraction of the *firſt* Priſme, did by Splitting dilate a Linear ray into a Superficial, the Croſs refractions of that *ſecond* Priſme ought by further ſplitting to dilate and draw that Superficial ray into a Pyramidal ſolid. But, upon tryal, I found it otherwiſe; the Image being as regularly Oblong as before, and inclin'd to both the Priſmes at an angle of 45. degrees.

I tryed alſo all other Poſitions of the ſecond Priſme, by turning the Ends about its middle part; and in no caſe could obſerve any ſuch Irregularity. The Image was ever alike inclined to both Priſmes, its Breadth anſwering to the Suns Diameter, and its length being greater or leſs accordingly as the Refractions more or leſs agreed, or contradicted one another.

And by theſe Obſervations, ſince the Breadth of the Image was not augmented by the Croſs refraction of the *ſecond* Priſme, that refraction muſt have been perform'd *without* any ſplitting or dilating of the ray; and therefore at leaſt the Light incident on that Priſme muſt be granted an Aggregat of Rays *unequally refrangible* in my ſenſe. And ſince the Image was equally inclin'd to both *Priſmes*, and conſequently the Refractions alike in both, it argues, that they were perform'd according to ſome *Conſtant Law* without any irregularity.

9. That there are more than two Original Colors.

To determine the *ſecond* Quære, the *Animadverſor* referrs to an Experiment made with two *Wedge-like boxes*, recited in the *Micrography* of the Ingenious Mr. *Hook* Obſerv. 10. pag. 73. the deſign of which was to produce *all* Colours out of a mixture of *two*. But there is, I conceive, a double defect in this inſtance. For, it appears not, that by this Experiment all colours can be produced out of two; and, if they could, yet the Inference would not follow.

That *all* Colours cannot by that Experiment be produced out of two, will appear by conſidering, that the Tincture of *Aloes*, which afforded one of thoſe Colours, was not all over of one uniform colour, but appear'd *yellow* near the edge of the Box, and *red* at other places where it was thicker: affording all variety of colours from a *pale yellow* to a *deep red* or Scarlet, according to the various thickneſs of the liquor. And ſo the ſolution of *Copper*, which afforded the other colour, was of various *Blews* and *Indigo's*. So that inſtead of *two* colours, here is a great variety made uſe of for the production of all others. Thus, *for inſtance*, to produce all ſorts of *Greens*, the ſeveral degrees of *Yellow* and *pale Blew* muſt be mixed ; but to compound *Purples*, the *Scarlet* and *deep Blew* are to be the Ingredients.

Now, if the *Animadverſor* contend, that all the *Reds* and *Yellows* of the one Liquor, or *Blews* and *Indigo's* of the other, are only various degrees and dilutings of the ſame Colour, and not divers colours, that is a Begging of the Queſtion : And I ſhould as ſoon grant, that the two *Thirds* or *Sixths* in Muſick are but ſeveral degrees of the ſame ſound, and not divers ſounds. Certainly it is much better to believe our Senſes, informing us, that *Red* and *yellow* are divers colours, and to make it a Philoſophical *Quære*, Why the ſame Liquor doth, according to its various thickneſs, appear of thoſe divers colours, than to ſuppoſe them to be the ſame colour becauſe exhibited by the ſame liquor ? For, if that were a ſufficient reaſon, then *Blew* and *Yellow* muſt alſo be the ſame colour, ſince they are both exhibited by the ſame Tincture of *Nephritick Wood*. But that they are *divers* colours, you will more fully underſtand by the reaſon, which, in my Judgment, is this : The Tincture of *Aloes* is qualified to tranſmit *moſt eaſily* the rays indued with *red*, *moſt difficultly* the rays indued with *violet*, and with *intermediat degrees of facility* the rays indued with *intermediat* colours. So that where the liquor is very thin, it may ſuffice to intercept moſt of the *violet*, and yet tranſmit moſt of the other colours ; all which together muſt compound a middle Colour, that is, a *faint yellow*. And where it is ſo much thicker as alſo to intercept moſt of the *Blew* and *Green*, the remaining *Green*, *Yellow*, and *Red*, it muſt compound an *Orenge*. And where the thickneſs is ſo great, that ſcarce any rays can paſs through it beſides thoſe indued with *Red*, muſt appear of that colour, and that ſo much the deeper and obſcurer, by how the liquor is thicker. And the ſame may be underſtood of the various degrees of *Blew*, exhibited by the Solution of *Copper*, by reaſon of its diſpoſition to intercept *Red* moſt eaſily, and tranſmit a *deep Blew* or *Indigo*-Colour moſt freely.

But, ſuppoſing that *all* Colours might, according to this experiment, be produced out of *two* by mixture; yet it follows not, that thoſe two are the only *Original* colours, and that for a double reaſon. *Firſt*, becauſe thoſe two are not themſelves Original colours, but compounded of others; there being no liquor nor any other body in nature, whoſe colour in Day-light is wholly un-compounded. And *then*, becauſe, though thoſe two were Original, and all others might be compounded of them, yet it follows not, that they cannot be otherwiſe produced. For I ſaid, that they had a double Origin, the ſame Colours to ſenſe being in ſome caſes compounded and in others un-compounded; and ſufficiently declar'd in my *third* and *fourth* Propoſitions, and in the Concluſion, by what Properties the one might be known and diſtinguiſh't from the other. But, becauſe I ſuſpect by ſome Circumſtances, that the *Diſtinction* might not be rightly apprehended, I ſhall once more declare it, and further explain it by Examples.

That Colour is *Primary* or *Original*, which cannot by any Art be changed, and whoſe Rays are not *alike* refrangible: And that *Compounded*, which is changeable into other colours, and whoſe Rays are *not alike* refrangible. *For inſtance*, to know, whether the colour of any *Green* object be compounded or not, view it through a Prime, and if it appear *confuſed*, and the edges tinged with *Blew*, *Yellow*, or any variety of other colours, then is that *Green* compounded of ſuch colours as at its edges emerge out of it: But if it appear *diſtinct*, and well defin'd, and entirely Green to the very edges, without any other colours emerging, it is of an Original and un-compounded Green. In like manner, if a refracted beam of light, being caſt on a white wall, exhibit a *Green* colour, to know whether that be compounded, refract the beam with an interpoſed Priſme; and if you find any Difformity in the refractions, and the *Green* be transform'd into *Blew*, *Yellow*, or any variety, of other colours, you may conclude, that it was compounded of thoſe which emerge: But if the Refractions be uniform, and the *Green* perſiſt without any change of colour, then is it Original and un-compounded. Andthe reaſon why I call it ſo, is, becauſe a *Green* indued with ſuch properties cannot be produced by any mixing of other colours.

Now, if two *Green* Objects may to the naked eye appear of the ſame colour, and yet one of them through a priſme ſeem *confuſed* and variegated with other colours at the edges, and the other *diſtinct* and entirely Green; or, if there may be two Beams of Light, which falling on a white wall do to the naked eye exhibit the ſame *Green* colour, and yet one of them, when tranſmitted through a Priſme, be uniformly and *regularly* refracted, and retain its colour unchanged, and the other be *irregularly* refracted and to divaricate into a multitude of other colours; I ſuppoſe, theſe two *greens* will in both caſes be granted of a different Origin and conſtitution. And if by mixing colours, a *green* cannot be compounded with the properties of the *Unchangeable* Green, I think, I may call *that* an *Un-compounded* colour, eſpecially ſince its rays are alike refrangible, and uniform in all reſpects.

The ſame rule is to be obſerv'd in examining, whether *Red*, *Orenge*, *Yellow*, *Blew*, or any other colour be compounded or not. And, by the way, ſince all *White* objects through the Priſme appear confus'd and terminated with colours, *Whiteneſs* muſt, according to this diſtinction, be ever compounded, and that the moſt of all colours, becauſe it is the moſt confus'd and changed by Refractions.

From hence I may take occaſion to communicate a way for the improvement of *Microſcopes* by Refraction. The way is, by illuminating the Object in a darkned room with Light of any convenient colour not too much compounded: for by that means the Microſcope will with diſtinctneſs bear a deeper Charge and larger Aperture, eſpecially if its conſtruction be ſuch, as I may hereafter deſcribe; for, the advantage in Ordinary Microſcopes will not be ſo ſenſible.

10. *That Whiteneſs is a mixture of all Colours.*

There remains now the *third* Quære to be conſider'd, which is, Whether *Whiteneſs* be an Uniform Colour, or a diſſimilar Mixture of all colours? The Experiment which I brought to decide it, the *Animadverſor* thinks may be otherwiſe explain'd, and ſo concludes nothing. But he might eaſily have ſatisfied himſelf by trying, what would be the reſult of a Mixture of all colours. And that very Experiment might have ſatisfied him, if he had pleaſed to examine it by the various circumſtances. One circumſtance I there declared, of which I ſee no notice taken; and it is, That if any colour at the *Lens* be intercepted, the *Whiteneſs* will be changed into the other colours: If all the colours but *red* be intercepted, that Red alone in the concourſe or croſſing of the Rays will not conſtitute Whiteneſs, but continues as much Red as before; and ſo of the other colours. So that the buſineſs is not only to ſhew, how rays, which before the concourſe exhibit colours, do in the concourſe exhibit *White*; but to ſhew, How in the ſame place, where the ſeveral ſorts of rays apart exhibit ſeveral colours, a Confuſion of all together make White. For inſtance, if red alone be firſt tranſmitted to the paper at the place of concourſe, and then the other colours be let fall on that Red, the *Queſtion* will be, Whether they convert it into White, by mixing with it only, as Blew falling on Yellow light is ſuppos'd to compound Green; or, Whether there be ſome further change wrought in the colours by their mutual acting on one another, untill, like contrary *Peripatetic* qualities, they become aſſimilated. And he that ſhall explicate this laſt Caſe *mechanically*, muſt conquer a double impoſſibility. He muſt *firſt* ſhew, that many unlike motions in a Fluid can by claſhing ſo act on one another, and change each other, as to become one Uniform motion; and *then*, that an Uniform motion can of it ſelf, without any new unequal impreſſions, depart into a great variety of motions regularly un-equal. And after this he muſt further tell me, Why all Objects appear not of the ſame colour, that is, why their colours in the Air, where the rays that convey them every way are confuſedly mixt, do not aſſimilate one another and become Uniform before they arrive at the Spectators eye?

But if there be yet any doubting, 'tis better to put the Event on further Circumſtances of the *Experiment*, than to acquieſce in the poſſibility of any *Hypothetical* Explication. As, for inſtance, by trying, What will be the apparition of theſe colours in a very quick Conſecution of one another. And this may be eaſily perform'd by the rapid gyration of a Wheel with many Spoaks or coggs in its perimeter, whoſe Interſtices and thickneſſes may be equal and of ſuch a largeneſs, that, if the Wheel be interpoſed between the Priſme and the white concourſe of the colours, one half of the Colours may be intercepted by a ſpoake or cogg, and the other half paſs through an interſtice. The Wheel being in this poſture, you may firſt turn it ſlowly about, to ſee all the colours fall ſucceſſively on the ſame place of the paper, held at their aforeſaid concourſe; and if you then accelerate its gyration, until the Conſecution of thoſe colours be ſo quick, that you cannot diſtinguiſh them ſeverally, the reſulting colour will be a Whiteneſs perfectly like that, which an un-refracted beam of Light exhibits, when in like manner ſucceſſively interrupted by the ſpoaks or coggs of that circulating Wheel. And that this *Whiteneſs* is produced by a ſucceſſive Intermixture of the Colours, without their being aſſimilated, or reduc'd to any Uniformity, is certainly beyond all doubt, unleſs things that exiſt not at the ſame time may notwithſtanding act on one another.

There are yet other Circumſtances, by which the Truth might have been decided; as by viewing the White concourſe of the Colours through another Priſme plac'd cloſe to the eye, by whoſe Refraction that whiteneſs may appear again transform'd into Colours: And then, to examine their Origin, if an Aſſiſtant intercept any of the colours at the *Lens* before their arrival at the Whiteneſs, the ſame colours will vaniſh from amongſt thoſe, into which that Whiteneſs is converted by the *ſecond* Priſme. Now, if the rays which diſappear be the ſame with thoſe that are intercepted, then it muſt be acknowledged, that the *ſecond* Priſme makes no new colours in any rays, which were not in them *before* their concourſe at the paper. Which is a plain indication, that the rays of ſeveral colours remain diſtinct from one another in the Whiteneſs, and that from their *previous* diſpoſitions are deriv'd the Colours of the *ſecond* Priſme. And, by the way, what is ſaid of their Colors may be applied to their Refrangibility.

The aforeſaid *Wheel* may be alſo here made uſe of; and, if its gyration be neither too quick nor two ſlow, the ſucceſsion of the colours may be diſcern'd through the Priſme, whilſt to the naked eye of a Byſtander they exhibit whiteneſs.

There is ſomething ſtill remaining to be ſaid of this Experiment. But this, I conceive, is enough to enforce it, and ſo to decide the controverſy. How-ever, I ſhall now proceed to ſhew ſome other ways of producing *Whiteneſs by mixtures*, ſince I perſwade my ſelf, that this Aſſertion above the reſt appears Paradoxical, and is with moſt difficulty admitted. And becauſe the *Animadverſor* deſires an inſtance of it in Bodies of divers colours, I ſhall begin with that. But in order thereto it muſt be conſider'd, that ſuch colour'd Bodies reflect but ſome part of the Light incident on them ; as is evident by the 13 *Propoſition :* And therefore the Light reflected from an Aggregat of them will be much weakned by the loſs of many rays. Whence a perfect and *intenſe* Whiteneſs is not to be expected, but rather a Colour between thoſe of Light and Shadow, or ſuch a Gray or Dirty colour as may be made by mixing White and Black together.

And that ſuch a Colour will reſult, may be collected from the colour of *Duſt* found in every corner of an houſe, which hath been obſerv'd to conſiſt of many colour'd particles. There may be alſo produced the like Dirty colour by mixing ſeveral *Painters colours* together. And the ſame may be effected by Painting a *Top* (ſuch as Boys play with) of divers colours. For, when it is made to circulate by whipping it, it will appear of ſuch a dirty colour.

Now, the Compounding of theſe colours is proper to my purpoſe, becauſe they differ not from Whiteneſs in the *Species* of colour, but only in *degree* of Luminouſneſs : which (did not the *Animadverſor* concede it) I might thus evince. A beam of the Suns Light being tranſmitted into a darkned room, if you illuminate a ſheet of White Paper by that Light, reflected from a body of any colour, the paper will always appear of the colour of that body, by whoſe reflected light it is illuminated. If it be a red body, the paper will be red ; if a green body, it will be green ; and ſo of the other colours. The reaſon is, that the fibers or threds, of which the paper conſiſts, are all tranſparent and ſpecular ; and ſuch ſubſtances are known to reflect colours without changing them. To know therefore, to what *Species* of colour a *Grey* belongs, place any Gray body (ſuppoſe a Mixture of *Painters colours*,) in the ſaid Light, and the paper, being illuminated by its reflexion, ſhall appear White. And the ſame thing will happen, if it be illuminated by reflexion from a *black* ſubſtance.

Theſe therefore are all of one *Species* ; but yet they ſeem diſtinguiſht not only by *degrees* of Luminouſneſs, but alſo by ſome other Inequalities, whereby they become more harſh or pleaſant. And the diſtinction ſeems to be, that *Greys* and perhaps *Blacks* are made by an uneven defect of Light, conſiſting as it were of many little veins or ſtreams, which differ either in Luminouſneſs or in the Unequal di-

ſtribution

ſtribution of diverſly colour'd rays; ſuch as ought to be cauſ'd by Reflexion from a Mixture of white and black, or of diverſly coloured corpuſcles. But when ſuch imperfectly mixt Light is by a *ſecond* Reflexion from the paper more evenly and uniformly blended, it becomes more pleaſant, and exhibits a *faint* or ſhadow'd Whiteneſs. And that ſuch little irregularities as theſe may cauſe theſe differences, is not improbable, if we conſider, how much variety may be cauſed in *Sounds* of the ſame tone by irregular and uneven jarrings. And beſides, theſe differences are ſo little, that I have ſometimes doubted, whether they be any at all, when I have conſider'd that a Black and White Body being plac'd together, the one in a ſtrong light, and the other in a very faint light, ſo proportion'd that they might appear equally luminous; it has been difficult to diſtinguiſh them, when view'd at diſtance, unleſs when the Black ſeem'd more blewiſh; and the White body in a light ſtill fainter, hath, in compariſon of the Black body, it ſelf appear'd Black.

This leads me to another way of *Compounding Whiteneſs*; which is, That, if four or five Bodies of the more eminent colours, or a Paper painted all over, in ſeveral parts of it, with thoſe ſeveral colours in a due proportion, be placed in the ſaid Beam of Light; the Light, reflected from thoſe Colours to another White paper, held at a convenient diſtance, ſhall make that paper appear White. If it be held too near the Colours, its parts will ſeem of thoſe colours that are neareſt them; but by removing it further, that all its parts may be equally illuminated by all the colours, they will be more and more diluted, until they become perfectly White. And you may further obſerve, that if any of the colours be intercepted, the Paper will no longer appear White, but of the other colours which are not intercepted. Now, that this *Whiteneſs* is a Mixture of the ſeverally colour'd rays, falling confuſedly on the paper, I ſee no reaſon to doubt of; becauſe, if the Light became Uniform and Similar before it fell confuſedly on the paper, it muſt much more be Uniform, when at a greater diſtance it falls on the Spectators eye, and ſo the rays, which come from ſeveral colours, would in no qualities differ from one another, but all of them exhibit the ſame colour to the Spectator, contrary to what he ſees.

Not much unlike this Inſtance it is, That, if a poliſht piece of Metal be ſo placed, that the colours appear in it as in a Looking-glaſs, and then the Metal be made rough, that by a confus'd reflexion thoſe apparent colours may be blended together, they ſhall diſappear, and by their mixture cauſe the Metall to look White.

But further to enforce this *Experiment* ; if, inſtead of the Paper, any White *Froth*, conſiſting of ſmall bubles, be illuminated by reflexion from the aforeſaid Colours, it ſhall to the naked eye ſeem White, and yet through a good Microſcope the ſeveral Colours will appear diſtinct on the bubles, as if ſeen by reflexion from ſo many ſpherical ſurfaces. With my naked eye, being very near, I have alſo diſcern'd the ſeveral colours on each buble ; and yet at a greater diſtance, where I could not diſtinguiſh them apart, the Froth hath appear'd entirely White. And at the ſame diſtance, when I look'd intently, I have ſeen the colours diſtinctly on each buble ; and yet, by ſtraining my eyes as if I would look at ſomething far off beyond them, thereby to render the Viſion confus'd, the Froth has appear'd without any other colour than Whiteneſs. And what is here ſaid of Froths, may eaſily be underſtood of the Paper or Metal in the foregoing Experiments. For, their parts are ſpecular bodies, like theſe Bubles : And perhaps with an excellent Microſcope the Colours may be alſo ſeen intermixedly reflected from them.

In proportioning the ſeverally Colour'd bodies to produce theſe effects, there may be ſome niceneſs ; and it will be more convenient, to make uſe of the colours of the Priſme, caſt on a Wall, by whoſe reflexion the Paper, Metal, Froth, and other White ſubſtances may be illuminated. And I uſually made my Tryals this way, becauſe I could better exclude any ſcattering Light from mixing with the colours to dilate them.

To this way of Compounding Whiteneſs may be referr'd that other, by Mixing light after it hath been trajected through tranſparently colour'd ſubſtances. *For inſtance*, if no Light be admitted into a room but only through Colour'd glaſs, whoſe ſeveral parts are of ſeveral colours in a pretty equal proportion; all White things in the room ſhall appear White, if they be not held too near the Glaſs. And yet this light, with which they are illuminated, cannot poſſibly be uniform, becauſe, if the Rays, which at their entrance are of divers colours, do in their progreſs through the room ſuffer any alteration to be reduced to an Uniformity ; the Glaſs would not in the remoteſt parts of the room appear of the very ſame colour, which it doth when the Spectators eye is very near it : Nor would the rays, when tranſmitted into another dark room through a little hole in an oppoſite door or partition-wall, project on a Paper the *Species* or repreſentation of the glaſs in its proper colours.

And, by the by, this ſeems a very fit and cogent Inſtance of ſome other parts of my *Theory*, and particularly of the 13 *Propoſition*. For, in this room all natural Bodies whatever appear in their proper colours. And all the *Phænomena* of colours in nature, made either by Refraction or without it, are here the ſame as in the Open Air. Now, the Light in this room being ſuch a Diſſimilar mixture, as

I have deſcrib'd in my *Theory*, the Cauſes of all theſe *Phænomena* muſt be the ſame that I have there aſſign'd. And I ſee no reaſon to ſuſpect, that the ſame *Phænomena* ſhould have other cauſes in the Open Air.

The ſucceſs of this Experiment may be eaſily conjectur'd by the appearances of things in a Church or Chappel, whoſe windores are of colour'd glaſs; or in the Open Air, when it is illuſtrated with Clouds of various colours.

There are yet other ways, by which I have produced *Whiteneſs*; as *by* caſting ſeveral Colours from two or more Priſmes upon the ſame place; *by* Refracting a Beam of Light with two or three Priſmes ſucceſſively, to make the diverging colours converge again; *by* Reflecting one colour to another; and *by* looking through a Priſme on an Object of many colours; and, (which is equivalent to the above mention'd way of mixing colours by concave *Wedges* fill'd with colour'd liquors,) I have obſerv'd the ſhadows of a painted Glaſs-window to become White, where thoſe of many colours have at a great diſtance interfered. But yet, for further ſatisfaction, the *Animadverſor* may try, if he pleaſe, the effects of four or five of ſuch *Wedges* filled with liquors of as many ſeveral colours.

Beſides all theſe, the Colours of *Water-bubbles* and other thin pellucid ſubſtances afford ſeveral inſtances of Whiteneſs produced by their mixture; with *one* of which I ſhall conclude this particular. Let ſome Water, in which a convenient quantity of Soap or waſh-ball is diſſolv'd, be agitated into Froth, and, after that froth has ſtood a while without further agitation, till you ſee the bubbles, of which it conſiſts, begin to break, there will appear a great variety of colours all over the top of every bubble, if you view them near at hand; but, if you view them at ſo great a diſtance that you cannot diſtinguiſh the colours one from another, the Froth will appear perfectly White.

II. *That the* Experimentum crucis *is ſuch*.

Thus much concerning the deſign and ſubſtance of the *Animadverſor's* Conſiderations. There are yet ſome particulars to be taken notice of, before I conclude; as the denyal of the *Experimentum Crucis*. On *this* I choſe to lay the whole ſtreſs of my diſcourſe; which therefore was the principal thing to have been objected againſt. But I cannot be convinced ot its inſufficiency by a bare denyal without aſſigning a Reaſon for it. I am apt to believe, it has been miſunderſtood; for otherwiſe it would have prevented the diſcourſes about Rarifying and Splitting of rays; becauſe the deſign of it is, to ſhew, that Rays of divers colours, conſider'd apart, do at *Equal* Incidences ſuffer *Unequal* Refractions, without being ſplit, rarified, or any ways dilated.

In the Conſiderations of my firſt and ſecond Propoſitions, the *Animadverſor* hath rendred my Doctrine of *Un-equal Refrangibility* very imperfect and maimed, by explicating it wholly by the Splitting of rays; whereas I chiefly intended it in thoſe Refractions that are perform'd without that ſuppos'd Irregularity; ſuch as the *Experimentum Crucis* might have inform'd him of. And, in general I find, that, whilſt he hath endeavour'd to explicate my Propoſitions *Hypothetically*, the more material ſuggeſtions, by which I deſign'd to recommend them, have eſcap'd his conſideration; ſuch as are, The Unchangeableneſs of the degree of Refrangibility peculiar to any ſort of rays; the ſtrict Analogy between the degrees of Refrangibility and Colours; the Diſtinction between compounded and un-compounded colours; the Unchangeableneſs of un-compounded colours; and the Aſſertion, that if any one of the Priſmatique colours be wholly intercepted, that colour cannot be new produced out of the remaining Light by any further Refraction or Reflexion whatſoever. And of what ſtrength and efficacy theſe Particulars are for enforcing the *Theory*, I deſire therefore may be now conſider'd.

12. *Some particulars recommended to further conſideration.*

An Accompt of two Books.

I. *Ottonis de Guericke EXPERIMENTA NOVA MAGDEBVRGICA, de VACVO SPATIO,* &c. Amſtelodami A. 1672. in fol.

After that the famous Author of this Book hath made a Narrative of the chief *Hypotheſes* and Opinions of both Antient and Recent Aſtronomers concerning the Syſteme of the world, and repreſented the great difficulties in the *Ptolemaique* and *Tychonique*, and repeated the Anſwers to the Objections againſt the *Copernican*; he at large gives us his own Thoughts of the Frame and Conſtitution of the *World*; By which *World* he underſtands in this Treatiſe the Complex of the Planets, diſpoſed and order'd much after the *Copernican* way, the *Sun* being ſeated in the midſt, having his Spots about him, and moving and influencing all the reſt of the Planets according to their ſeveral diſtances from him; *Saturn* making the utmoſt of all the Planets, and the End of this his World being there, where the diffuſive power and vertue of the Sun, the King and Governor of them all, terminates; which bounds he conjectures to extend themſelves, beyond *Saturn*, to thoſe Fixt Stars that are of the nearer rank to *Saturns* Orbe.

Concerning the Bodies lodged in theſe Planets, he thinks it conſonant to the Power and Wiſdom of the Great Creator, that there ſhould be ſuch a variety of them, as to ſtock each of the ſaid Planets with creatures differing from thoſe of others: ſo that nothing of what is in(e. g.)our Earth or Terr-aqueous Globe, is to be found in any of the other Planets, but that every one of them is ſtored with peculiar creatures, and even with ſuch reaſonable ones, as are of another kind from the Men of our Earth.

As to the *Space* that is between thoſe his Mundan Bodies (the Planets,) he conceives it to be not any thing Material or Corporeal, but a *Meer ſpace* void of all body, which *Space* he defines to be as 'twere the Univerſal Veſſel containing all Bodies; declaring herein his diſſent from *Des-Cartes*, in whoſe opinion *Space* or Extenſion cannot be without an extended ſubſtance : whereas he (our Author) makes *Space* indifferent to the being or not being filled with bodies.

Treating of this *Space*, which he calls *Void*, and eſteems ſo in its own nature, he maketh it Immenſe and Infinite : And diſcuſſing that ſo much agitated Queſtion, whether there be a *Vacuum*, he concludes it in the Affirmative, aſſerting, that not only all thoſe parts of his *Space*, to which the Effluvia or Expirations of his World do not reach, are void of all body, but alſo, that ſo much of Water, Air, or any other thing as is exhauſted out of veſſels, no other body ſucceeding in its room, ſo much there is of Vacuity there. To prove which latter, he repeateth in this volume many of thoſe Experiments of his, which the Learn'd *Schottus* had publiſh't before : adding ſome others, together with ſome improvements of his Engin ; which was alſo deſcribed by the ſaid *Schottus*, and in which two very conſiderable things were deficient, as is obſerv'd by Mr. *Boyle*, the Noble Author of the *New Experiments Phyſico-Mechanical touching the Air*, p. 6, 7. in the firſt *Engliſh* Edition, printed A. 1660. at *Oxford*, and enrich't ſince, by the ſame, with a *Continuation of New Experiments touching the Spring and Weight of the Air, and their effects*, printed A. 1669. in the ſame place : Which two Treatiſes being compar'd with what hath been heretofore publiſh't by the aforeſaid *Schottus*, and now by this Author, it will eaſily appear to ſagacious and impartial Readers, to which of theſe two Gentlemen, Mr. *Boyle* and Monſ. *De Gericke*, the Curious are moſt obliged, there having been at firſt but ſix experiments made by the *latter* of them, publiſht by *Schottus*, in *Arte Hydrantico pneumatica*, about A. 1656; which afterwards were called *Antiqua* by the ſame, in his *Technica Curioſa*, printed A. 1662; in which are alſo recorded the other Experiments, call'd *Experimenta Magdeburgica Nova*, two years after Mr, *Boyles* lately mention'd *firſt* Book ; the *Continuation* of which hath been abroad *three* years before this of *de Gericke* himſelf, now under conſideration.

Concerning our Authors Contrivance of his *Virunculus* or little Man, made to indicate the Weight of the Air at any time, and to foretell Wind and Weather; ſince he thinks fit to make a ſecret of it, we muſt let him enjoy it alone, till he ſhall think good to diſcloſe it.

But touching his Experiment of a New and before never uſed *Wind-gun*, (as he calls it) whereby, contrary to the common Wind-guns, in which by ſtore of well-compreſs'd Air, Bullets may be ſhot, he teacheth, that by evacuating and weakning the Air, the like effect may be produced; as to this, I ſay, the Reader will find the ſame Principle made uſe of by Mr. *Boyle* in his lately-mention'd *Continuation*, the fourth Experiment about a *New Hydraulo-pneumatical Fountain, made by the Spring of un-compreſſed Air*.

As to the Experiment related by this Author *l.* 3. *c.* 7. of making Water fall in *vacuo*, with ſuch a noiſe, as if it were a hard ſubſtance, it appears by the *Journal* of the *R. Society*, that ſuch an one was made before that Illuſtrious company by Mr. *Boyle* ſome years ago.

For a concluſion of this Accompt, *I* ſhall take notice of an Experiment, mention'd by our Author, *l.* 5. *c.* 15; by which he thinks may be repreſented the chief Vertues, he enumerates of our Earth, perform'd by a Globe of Sulphur melted and cooled again, and then perforated, to traject an Iron *axis* through it for circumvolution; whereby, attrition being uſed withal, he affirms that the Impulſive, Attractive, Expulſive, and other vertues of the Earth, as he calls them, may be ocularly exhibited. How far this Globe and its performance may be confided in, the Tryals and Conſiderations of ſome Ingenious perſons here may perhaps inform us hereafter.

II, *Theſaurus MEDICINÆ PRACTICÆ*; *ſtudio & operâ* Thomæ Burnet *Scoto-Britanni, M. D. & Medici Regis Ordinarii*: Londini *impenſis* R. Boulter *apud inſigne* Capitis Turcæ in vico dicto *Cornhill*, 1672. in 4*o*.

THis Learn'd and Induſtrious Author, having conſidered the ſeveral abilities of Phyſicians, and the different ways of their writings reſpectively; ſome delivering Medical Inſtitutions and Controverſies; ſome commenting upon *Hippocrates* and *Galen*; others publiſhing Methods of Curing Diſeaſes and Practical Phyſicks; others augmenting the Medical matter, and teaching the way of Preparing Medicines; many improving Anatomy; and not a few recording Obſervations and Conſultations: Having, I ſay, conſidered this variety and diverſity, he preferrs the laſt way of all as appearing to him moſt uſefuf to Mankind; and therefore undertaketh in this Work of his to give us a Treaſure of Practical Phyſick, collected from the Obſervations and Advices of a great number of Phyſical Writers, both Ancient and Modern, ſuch as he eſteemed to be moſt conſiderable of that profeſſion. In the doing of which, he enumerates in an *Alphabetical* order about 410 kinds of Diſeaſes of humane Bodies, partly inward, partly outward; deſcribing their nature and ſymptomes, and declaring withal the ways of cure, as they are to be met with in thoſe many Authors, he affirms to have carefully conſulted: Of which there are by him alledged no leſs than 117.

Amongſt all theſe Chapters of *Diſeaſes* and their Cures there are interſperſed many not common Obſervations of Nature, ſuch as are: *That* the force of *Caſtoreum* is ſuch, That about the Iſles of *Fero*, the Fiſhermen, when their Boats are endangered by Whales, throw ſome of that ſubſtance into the Sea-water, which being beaten with it, the Fiſh immediately ſinks to the bottom: *That* Vinegar may be preſerv'd from all worms, by mixing a little Theriac therewith, and ſo expoſing it in a cloſe veſſel to the Sun for a moneth, daily ſhaking it, and afterwards percolating it when ſetled: *That* there are men, that ruminate properly ſpeaking, like Beaſts that chew the Cud, and that ſome of ſuch perſons when opened after death, have either their *æſophagus* every where fleſhy like a Muſcle, or their ſtomach very rough and large; Where 'tis alſo obſerved, that one of ſuch ruminating men, did not at all chew the cud when ſick, juſt like Oxen and Cows, that are ſaid by country-people to do ſo neither, when they are not well: *That* a certain Sea-man, that had lived long at Sea, and contracted from a continual defluxion a Cough, which exerciſed his Lungs for two years, did at length caſt out, together with blood, two conſiderable ramifications of veins, ſeparate from all parenchymatous matter, ſhewing the corruption of the whole ſubſtance of the Lungs: *That* it hath been obſerved to be dangerous, to have a vein opened at once in both arms, or leggs, which is here called a *Neronian* Venæ-ſection, *&c.*

Errata to be corrected in *Numb.* 87.

Pag. 5067. *l penult*, **Tractatu.** *p.* 5058. *l.* 43. **Demonſtratas.** *p.* 5069 *l.* 10. non *in* **AX.** *p.* 5070. *l.* 23. particularem vel defenſionem. *ibid. l.* 35. *pro* **2 PQL** *leg.* **-2PQL.** *ib. lin.* 29. *ad margin. lege*, **Vide Tab.** *II.* **Fig.** *III. p* 5071. *l.* 16. eſt media. *ibid. l.* 31 *pro* 1 L √c$\frac{1}{2}$ *leg.* 1-√c$\frac{1}{2}$. *p.* 5072. *l.* 35 *pro* $\frac{4}{1000000}$, *l.* $\frac{4}{100000}$, *p.* 5073. *l.* 18. *pro* quid. *l*, quin. *p.* 5074. *l.* 23. 27. *&c. pro* σ T, *l.* 6T. *ibid l.* 23. *pro* ſ2, *l.* S2. *ibid. l.* 31. *pro* $\frac{T}{3L}D^3$ *l.* $\frac{L}{6T}D^3$ *p.* 5075. l. 2. *pro* $\frac{1}{4}$ LD3, *l.* $\frac{1}{4}$ LD2 *ib. l.* 29. *l.* It. *pro* idem. *ib. l.* 39. *Hyperbola ſit Scalena.*

Errata in this Numb. 88.

Pag. 5087. l. 7. r. *Bodies.* p. 5094. l. 34. r. *it muſt.* p. 5097. l. 9. r. *and made to divaricate.*

LONDON,

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PHILOSOPHICAL TRANSACTIONS.

Decemb. 16. 1672.

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Some Obſervations about Shining Fleſh, *made by the Honourable* Robert Boyle; *Febr. 15. 16*$\frac{71}{72}$. *and by way of Letter addreſſed to the Publiſher, and preſented to the* R. Society.

YEſternight when I was about to go to bed, an *Amanuenſis* of mine, accuſtom'd to make Obſervations, informed me, that one of the Servants of the houſe, going upon ſome occaſion into the Larder, was frighted by ſomething of Luminous that ſhe ſaw (notwithſtanding the darkneſs of the place,) where the meat had been hung up before: Whereupon ſuſpending for a while my going to reſt, I preſently ſent for the meat into my Chamber, and cauſed it to be placed in a corner of the room capable of being made conſiderably dark, and then I plainly ſaw, both with wonder and delight, that the joint of meat did in divers places ſhine like rotten Wood or ſtinking Fiſh; which was ſo uncommon a ſight, that I had preſently thoughts of inviting you to be a ſharer in the pleaſure of it. But the late hour of the night did not only make me fear to give you too unſeaſonable a trouble, but being joyned with a great Cold I had got that day by making Tryal of a new Teleſcope (you ſaw,) in a windy place, I durſt not ſit up long enough to make all the tryals that I thought of and judg'd the occaſion worthy of. But yet, becauſe I effectually reſolved to imploy the little time I had to ſpare, in making ſuch Obſervations and tryals, as the accommodations, I could procure at ſo inconvenient an hour, would enable me, I ſhall here give you a brief account of the chief circumſtances and *Phænomena*, that I had opportunity to take notice of.

1. Then I muſt tell you, that the ſubject, we diſcourſe of, was a Neck of Veal, which, as I learned by inquiry, had been bought of a Country-butcher on the Tueſday preceding.

2. In this one piece of meat I reckoned diſtinctly above *twenty* ſeveral places that did all of them ſhine, though not all of them alike, ſome of them doing it but very faintly.

3. The bigneſs of theſe Lucid parts was differing enough, ſome of them being as big as the nail of a mans middle finger, ſome few bigger, and moſt of them leſs. Nor were there figures at all more uniform, ſome being inclined to a round, others almoſt oval, but the greateſt part of them very irregularly ſhap'd.

4. The parts that ſhone moſt, which 'twas not ſo eaſie to determine in the dark, were ſome griſtly or ſoft parts of the bones, where the Butcher's Cleaver had paſſed; but theſe were not the only parts that were luminous; for by drawing to and fro the *Medulla ſpinalis,* we found, that a part of that alſo did not ſhine ill: And I perceived one place in a *Tendon* to afford ſome light; and laſtly three or four ſpots in the fleſhy parts at a good diſtance from the bones were plainly diſcovered by their own light, though that were fainter than in the parts above mentioned.

5. When all theſe Lucid parts were ſurvey'd together, they made a very ſplendid ſhew; but 'twas not ſo eaſie, becauſe of the moiſtneſs and groſſneſs of the lump of matter, to examine the degree of their Luminouſneſs, as it is to eſtimate that of Gloworms, which being ſmall and dry bodies may be conveniently laid in a book, and made to move from one letter or word to another. But by good fortune having by me the curious *Tranſactions* of this month, I was able ſo to apply that flexible paper to ſome of the more reſplendent ſpots, that I could plainly read divers conſecutive letters of the Title.

6. The Colour that accompanied the light was not in all the ſame, but in thoſe which ſhone livelieſt, it ſeemed to have ſuch a fine Greeniſh blew, as I have divers times obſerved in the tails of Gloworms.

7. But notwithſtanding the vividneſs of this Light, I could not by the touch diſcern the leaſt degree of Heat in the parts whence it proceeded;and having put ſome marks on one or two of the more ſhining places, that I might know them again when brought to the light, I applied a ſeal'd Weather glaſs, furniſhed with tincted ſpirit of wine, for a pretty while, and could not ſatisfie my ſelf, that the ſhining parts did at all ſenſibly warm the liquor: But the Thermoſcope,though good in its kind,being not fitted for ſuch nice Experiments, I did not build much upon that tryal.

8. Notwithſtanding the great number of lucid parts in this Neck of Veal, yet neither I, nor any of thoſe that were about me,could perceive by the ſmell the leaſt degree of ſtink, whence to infer any Putrefaction; the meat being judged very freſh and well condition'd and fit to be dreſſed.

9. The floar of the Larder, where this meat was kept,is almoſt a ſtory lower then the level of the ſtreet, and 'tis divided from the Kitchen but by a partition of boards, and is furniſhed but with one window, which is not great, and looks toward the ſtreet, which lyes North-ward from it.

10. The wind, as far as we could obſerve it, was then at Southweſt, and bluſtering enough. The Air by the ſeal'd Thermoſcope appeared hot for the ſeaſon.The Moon was paſt its laſt Quarter. The Mercury in the Barometer ſtood at $29\frac{3}{16}$ inches.

11. We cut off with a knife one of the luminous parts, which proved to be a tender bone, and being of about the thickneſs of a half Crown piece, appeared to ſhine on both ſides though not equally; and that part of the bone, whence this had been cut off, continued joined to the reſt of the Neck of Veal, and was ſeen to ſhine, but nothing near ſo vividly as the part, we had taken off, did before.

12. To try, whether I could obtain any juice or moiſt ſubſtance from this, as I have ſeveral times done from the tails of Gloworms; I rub'd ſome of the ſofter and more lucid parts, (which I cauſed to be purpoſely cut off,) as dextrouſly as I could, upon my hand, but I did not at all perceive any luminous moiſture was thereby imparted; though the fleſh ſeemed by that operation to have loſt ſome of its light.

13. I cauſed alſo a piece of ſhining fleſh to be compreſſed betwixt two pieces of glaſs, to try, how well the contexture of it would reſiſt that external force; but I did not find the light to be thereby extinguiſhed during the ſhort time I could allot to the Experiment.

14. But ſuppoſing, that high rectified Spirit of wine might ſo alter the contexture of the body it permeated, as to deſtroy its faculty of Shining, I put a luminous piece of Veal into a Cryſtalline phial, and pouring on it a little pure Spirit of wine that would have burned all away, after I had ſhaken them together, I laid by the glaſs, and in about a quarter of an hour or leſs I found that the light was vaniſhed.

15. But water would not ſo eaſily quench our ſeeming fires; for having put one of them into a *China* Cup, and almoſt filled it with cold water, the light did not only appear, perhaps undiminiſhed, through that Liquor, but above an hour after was vigorous enough not to be eclipſed by being looked upon at no great diſtance from a burning Candle, that was none of the ſmalleſt; and probably the light would have been ſeen much longer, if we could have afforded to watch out its duration.

16. Whilſt theſe things were doing, I cauſed the Pneumatical Engine to be prepared in a room without fire, (that the Experiment might be tryed in a greater degree of darkneſs;) and having conveyed one of the largeſt luminous pieces into a ſmall Receiver, we cauſed the candles to be put out, and the pump to be plied in the dark; but

the diminution of light, after the pump ſeemed to have been imployed for a competent while, appeared ſo inconſiderable, (whether becauſe our eyes had leaſure to be fitted to that dark place, or for what other cauſe ſoever,) that I began to ſuſpect, that the inſtrument, having been managed in the dark, had leaked all the while. Wherefore cauſing the lights to be brought in, and a *Mercurial Gage* to be put into the Receiver; when we were ſure that this glaſs was well cemented on to the Engine, the Candles being removed, the pump was ſet a work again; and then opening my eyes, which I had kept clos'd againſt the light of the Candles, I could perceive, upon the gradual withdrawing of the Air, a diſcernible and gradual leſſening of the light; which yet was never brought quite to diſappear (as I long ſince told you the light of Rotten Wood and Gloworms had done,) or to be ſo near vaniſhing as one would have expected; though upon the bringing in of the Candles again it appeared by the *Gage,* that the Pump had been diligently applied. But the room being once again darkened; by the haſty increaſe of light, that had diſcloſed it ſelf in the Veal upon this letting in of the Air to the Exhauſted Receiver, it appeared more manifeſtly than before, that the decrement, though but ſlowly made, had been conſiderable. This tryal we once more repeated with a not unlike ſucceſs; which though it convinced us, that the Luminous matter of our included body was more vigorous or tenacious than that of moſt other ſhining bodies; yet it left us ſome doubts, that the light would have been much more impaired, if not quite made to vaniſh, if the ſubject of it could have been kept long enough in our Exhauſted Receiver: But the unſeaſonable time of the night reducing me at length to go to bed, I could not ſtay to proſecute this or any other tryal.

17. Only, whilſt I was undreſſing, this further Obſervation occur'd, that ſuppoſing there might be in the ſame Larder more joints of the ſame Veal than one, innobled

with this ſhining faculty, it was found, that a Legg of Veal, which was cauſed to be brought into my Chamber, had ſome ſhining places in it; though they were but very few and faint in compariſon of thoſe, that were conſpicuous in the above-mentioned Neck.

18. What further *Phænomena* this morning might have afforded me, I cannot tell, having been haſtily called up before day for a Niece, that I am very juſtly and exceedingly concerned for, who was thought to be upon the point of death, and whoſe almoſt gaſping condition had too much affected and imployed me, to leave me any time for Philoſophical entertainments, that require a calm, if not a pleaſed, mind. Only this I took notice of, becauſe the obſervation could not coſt me a minute of an hour, that whilſt they were bringing me Candles for to riſe by, I looked upon a clean phial, that I had laid upon the bed by me after a piece of our luminous Veal had been included in it, and found it to ſhine vividly at that time, which was between four and five of clock this morning, ſince when I have made no one obſervation or tryal.

POSTSCRIPT.

19. Near two days after I had made the forementioned Obſervations, thoſe horrid ſymptoms of my Niece's diſeaſe, that had ſo much allarmed the Phyſitians and me, being through Gods goodneſs conſiderably abated, I began to reſume the thoughts of our Shining Veal, and though, having in the hurry I was in forgotten to take any order about it, I found it was already diſpoſed of; yet the piece, I lately mentioned to have been included in a phial, being preſerved in it, I looked upon it the third day (incluſively) after we had firſt obſerved the meat, 'twas cut off from, to be luminous; and I found it to ſhine in the dark as vigorouſly as ever. The fourth day its light was alſo conſpicuous, ſo that I was able in a dark Corner of the room to ſhew

it even in the day time to three or four very ingenious Phyſitians, all of them (ſave one) members of the *R. Society*; and I preſume I need not re-mind you, that the following night I invited you to be a *ſpectator* of it, though before that time the light had begun to decay and the offenſive ſmell to grow ſomewhat ſtrong: which ſeems to argue, that the diſpoſition, upon whoſe account our Veal was luminous, may very well conſiſt both with its being and not being in a ſtate of *putrefaction*, and conſequently is not likely to be derived meerly from the one or the other. The fifth day, in the morning looking upon it when I awaked, and before the curtains were opened, it ſeemed to ſhine better than it had done the day preceding. The ſame night alſo it was manifeſt enough, though not vivid, in the dark. When I awaked, the ſixth day in the morning after the Sun was riſen, I could within the Curtain perceive a glimmering light. But the ſeventh day, which was yeſterday, I could not late at night diſcern any light at all.

You ſaw too much in what a condition I was, when you did me the favour to viſit me, to expect that I ſhould preſume to entertain you with any Speculations about the cauſe of theſe unuſual apparitions of light. 'Tis true indeed, that in ſome notes, I formerly mentioned to you, I endeavoured to make it probable, that whether Light depend upon a particular kind of Impulſe propagated through a tranſparent *Medium*; or upon a Diffuſion of extreamly little parts from the Luminous body; or upon the Action of ſome other corporeal agent; what ever the Efficient be, the Effect is produced in a *Mechanical* way. But though I had theſe papers by me; yet to determine what peculiar Kind of motions or other operations Nature really imployed in the production of a light, which ſeemed not clearly (by what I ſhall preſently note) referable either to the particular and ſetled conſtitution of the *Animals*, whoſe fleſh ſhined, (as in our Gloworms and ſome *American* flies;)

or to that inteſtine and unuſual motion of the parts, that cauſes or accompanies Putrefaction in Rotten Wood or Fiſhes; ſince upon the firſt and livelieſt appearance of the Light, there was not any (at leaſt that could be taken notice of by the ſenſes:) To determine this, I ſay, it ſeem'd to me ſo difficult a task, that I ſhall willingly leave the Solution of ſuch abſtruſe *Phænomenas* as ſome of ours unattempted; eſpecially ſince I may, God permitting, make an Hiſtorical mention of them the day after to morrow at the Meeting of the *Royal Society*; where I doubt not much more and more to the purpoſe will be ſaid and conſider'd, than I have vanity to think my ſelf capable of offering. Only, for the prevention of ſome needleſs conjectures, to which without this previous Advertiſement one might upon plauſible grounds indulge, I ſhall in the mean while add and conclude with one Obſervation more, which may poſſibly take off our thoughts from ſtriving to deduce the Shining of our Veal from the peculiar nouriſhment, or conſtitution, or properties of that individual Calf, whoſe fleſh, *&c.* was luminous. For, having ſeveral nights ſent purpoſely into the Larder, to obſerve, whether any Veal, ſince brought thither, or any other meat, did afford any light, a negative anſwer was alwaies brought me back; ſave at one time, which happened to be within leſs than 48 hours of that, at which the Luminouſneſs of the Veal had been firſt taken notice of; for at this time there was in the ſame Larder a conſpicuous light ſeen in a *Pullet*, that hung up there, which having caus'd to be brought up into a darkned place in my chamber in the night time, I perceived four or five luminous places, which were not indeed near ſo large as thoſe of the Veal, but were little leſs vivid than they. All of theſe I took notice to be either upon or near the Rump, and that, which appear'd moſt like a Spark of Fire, ſhone at the very tip of that part. Yet was not this Foul mortified, nor at all ill-ſented, but ſo freſh, that the next day I found it very good meat. But whether this may reaſonably lead to a ſuſpicion, that the peculiar conſtitution of the *Air* in that Larder, and at that time, may as well deſerve to be taken into conſideration, as the peculiar nature of the *Animals* whoſe fleſh did ſhine, is a queſtion, that I, who have ſcarce time to name it, muſt not preſume to do any more than name. And therefore as ſoon as I have begg'd your pardon for this tedious though haſty ſcrible, I ſhall without Ceremony ſubſcribe my ſelf, *&c.*

A Deſcription of an odd kind of Muſhrom, *yeilding a Milky Juice, much hotter upon the tongue than Pepper*, &c. *Obſerved by Mr.* Liſter, *and by him communicated to the Publiſher*, Novemb. 15. 1672.

THe 18 of *Auguſt* laſt I paſſed through *Marton* woods, under *Pinno-moor* in *Craven*: In theſe Woods I then found an infinite number of *Muſhroms*, ſome wither'd, and others new-ſprung and flouriſhing. They were of a large ſize, ſomething bigger than the *Ordinary red-gilled eatable* Muſhrom or Champignon, and very much of their ſhape, that is, with a perfectly round Cap, or Stool (as we vulgarly call it,) thick in fleſh and with open Gills underneath; having a thick, fleſhy, not-hollow, and round Foot-ſtalk, of about 6 fingers breadth high above ground, and ordinarily as thick as my thumb. If you cut any part of this Muſhrom, it will bleed exceeding freely a Milk-white Juice, concerning which note; 1. That this Milky Juice taſts much hotter upon the tongue than Pepper. 2. That it is not clammy to the touch. 3. That the Air does not much diſcolour it, or the blade of a knife; as is uſual with moſt Vegetable Juices. 4. That it became in the glaſs-viol, I drew it into, ſuddenly concret and ſtiff, and did in ſome daies dry into a firm Cake. 5. That it then alſo, when well dried, retain'd its fierce biting taſt and white colour.

Further, I obſerv'd theſe Muſhroms, full of Juice, not to be endured upon our tongues, to abound with Fly-maggots.

Alſo, the youngeſt and tendreſt of them, that is, ſuch as are moſt Juicy, to have been very much eaten by the *Grey meadow naked Snail*, lodging themſelves within the ſides of the plant.

Concerning this kind of biting Muſhrom, I find in a certain late diſcourſe of the *State* of *Ruſſia* theſe words ; *Groozſhidys Fungorum maximi, palmam lati, inſtar Omaſi bibuli ſunt, craſſi & candidi ; dum crudi ſunt, ſucco (lacteo putà) abundant. Eos ſicut Tithymallum muriâ corrigunt* Rutheni ; *aliter fauces & guttur inflammabunt. Ipſe ſemel nimis inconſideratè aſſatos comedere tentabam, non ſine ſuffocationis periculo.* The reference to the Cuts or Figures is here confuſed, and the deſcription too conciſe, to ſay that Ours agrees in any thing with Theirs, ſave the great acrimony of the Juice they both yield.

I may ſometime acquaint you with the Medicinal Uſes, I have cauſed to be made of this *White Reſin:* In the mean time I ſhall only mind you of the great affinity it hath with *Euphorbium.*

Since this Letter the Author thereof was pleaſed to give us this further Account in an other of *Decemb.* 17. *viz.*

——Mr *Wray* return'd me this Anſwer to my Letter about the biting Mushrom ;

"At my return to *Midleton* I found a Letter from you, "containing the Deſcription of a Muſhrom by you diſco-"ver'd in *Marton*-woods under *Pinno moor.* I doubt not "but it is that deſcribed in *Joh. Bauhin l.* 40. *c.* 6. under the "title of *Fungus piperatus albus, lacteo ſucco turgens.* Only he "ſaith ; 1. That it doth in bigneſs exceed the *Champignon* ; "whereas you write, that there are few of them much big-"ger than *that :* But yet in ſaying ſo, you grant them to be "bigger. 2. He ſaith, for their bigneſs they are not ſo thick "as *that*; you deſcribe yours to be thick in fleſh. In all other "points the Deſcriptions agree exactly. For the *colour*, that “it is white, Gills and all; for the *place*, that it grows in “woods; and for the *taſt*, that 'tis hotter than Pepper. Several particulars mention'd by you, are not obſerv'd or “not mention'd by him. I cannot ſay, that I have as yet met “with this Muſhrom.

An Extract of Mr. Flamſtead's *Letter written to the Publiſher from* Derby Novemb. 16. 1672. *concerning the Appulſes, by him calculated for A.* 1673. *of the Moon, and the other Planets to Fixed Stars; together with an Obſervation of the Planet* Mars, *made by the ſame.*

—I Herewith ſend you my Annual task, but ſlightly done. Indeed my frequent Journeys and domeſtick buſineſſes have kept me ſo employ'd, that I have not had time to make ſuch Calculations as I intended. I have only noted the Time of the Moons true Conjunction with the Fixed Stars from the Learned *Heckerus* his *Ephemerides*, with the point then aſcending at *London*; with a conjecture therefrom, when the Viſible Occultations ſhall happen: from which the intelligent Obſerver may be ſufficiently inform'd, when to wait for any appearance, and what will be obſervable.

Beſides, having of late obſerved, with my ſeven foot Tube, ſome Appulſes of the other Planets to Fixed Stars, and collected all the Obſervable ones of the next year, I have added them to the *Lunar* Appulſes. Both are very ſlender labours, but may be very uſeful.

September laſt I was at *Townley*. The firſt week that I intended to have obſerved ♂ there with Mr. *Townley*, I twice obſerv'd him, but could not make two Obſervations, as I intended, in one night. The firſt night after my return, I had the good hap to meaſure his diſtances from two Stars the ſame night; whereby I find, that his *Parallax* was very ſmall; certainly not 30 ſeconds: So that I believe, the Suns *Parallax* is not more than 10 ſeconds. Of this Obſervation I intend to write a ſmall Tract, when I ſhall gain leiſure; in which I ſhall demonſtrate both the Diameter and Diſtances of all the Planets by Obſervations; for which I am now pretty well fitted.

Having obſerv'd the Diſtances and Poſitions of the 3 Stars, by which ♂ made his *tranſit*, I find, that *Tycho* errs 5 minutes at leaſt both in the Places and Latitudes of them compared one with another. And certainly he errs as much in many others; ſo that the labour of Monſieur *Hevelius* to rectify their places is very needful. Not that I find fault with *Tycho*; 'tis a wonder, (conſidering how difficult it is to ſet plain Sights to a ſmall Star) that ever he performed ſo much and ſo well: But if M. *Hevelius* uſe not Glaſſes in their room, I fear, we ſhall but be where we were; and yet without this Reſtitution we cannot expect any thing certain, much leſs accurate, in Aſtronomy.

Lunæ ad Fixas Appulſus, *Londini* A. 1673. Obſervabiles: A locis ejus veris, in Ephemeridibus *Heckeri* conſignatis, præviſi, & brevibus notis deſcripti à *Joh. Flamſtead* Anglo.

1673.

Januar.

d. *h.* ' ° ' ° '

17. 8. 21. *☽ cum Fixa in* ♊ 3. 34. *cum lat. Sept.* 4. 36. *Fixæ latitudo* 3°-57'. *horoſcopus* ♍ $29\frac{3}{4}$. *Ergo Luna circa horam* 9. *abſcondet ſtellam Auſtrali limbo.*

h. ' ° ' ° '

22. 10. 4. *☽ cum Fixa in* ♌ 18. 56. *latitudo vera ſua* 0-46. *Sept. Fixæ latitudo* 0°-16'. *Sept. Horoſcopus* ♎ 11. *Propterea Luna ante horam* 9. *abſcondet* ✳am *medio limbi ſui, vel circa paludem Mareotidis. Eadem nocte,*

Hora 16. 10'. *Luna cum alia Fixa in* ♌ 22°-45'. *Lunæ tunc vera latitudo* 0° 25'. *Sept. Fixæ* 0°-00'. *Horoſcopus* ♐ 17. *Ergo Lunæ limbus borealis poſt horam ibit infra ſtellam.*

24. 14h. 7'. *Lunæ in* ♍ 22°-28'. *latitudo Meridionalis* 2°-5'. *Fixæ in eodem loco latitudo: item Mer.* 3°-2'. *Horoſcopus* ♍ $25\frac{2}{3}$. *Ergo Luna, paulo poſt mediam noctem, vel ſtellam limbo Auſtrino abſcondet, vel modico intervallo ſupertranſibit.*

Februar.

d. *h.* ' ° ' ° '

16. 11. 21. *Luna in* ♋ 14-19. *latitudo ejus* 3-36. *Fixæ latitudo* 2°-56'. *Bor. Horoſc.* ♏ 12. *Ergo Luna, poſt ſemihoram, ſtellam lucis* 6æ *medio limbi obſcuri ſui occultabit.*

h. ' ° ' ° '

17. 15. 51. *Luna cum Fixa in* ♌ 2-48. *latitudo vera* 2-12. *Sept. Fixæ latitudo etiam Sept.* 1°-14'. *punctum oriens* ♑ 6. *Luna propterea, poſt ſemihoram, Auſtrino limbo abſcondet ſtellam.*

h. ' ° '

19. 7. 46. *Luna in* ♌ 25. 52. *latitudinem habet Auſt.* 1-5. *Fixa* 1° 25'. *Punctum Eclipticæ aſcendens eſt* ♎ $6\frac{1}{2}$. *Ergo Luna ante ſeſquihoram boreali parte limbi obſcuri ſtellam lucis* 5æ *abſcondet.*

Martii

h. ' ° '

12. 5-59. *Lunæ cum lucida Pleiadum latitudo* 5-10. *borealiſſimæ inter Pleiades* 4°. 28'. *Sept. Horoſcopus* ♍ $23\frac{1}{2}$. *Luna ergo ante horam* 8. *auſtrali limbo abſcondet ſtellam.*

h. ' ° ' ° '

14. 7-11. *Luna cum fixa in* ♊ 23-59. *latitudinem habet* 4-40. *Fixa tantum* 4°-6'. *Sept.; oriente* ♎ $15\frac{1}{2}$. *Luna ergo Fixam medio limbi obſcuri, poſt ſemihoram, occultabit.*

18.

h. ′ ° ′ ° ′
18. 10-57. *Luna in* ♌ 22-45. *latitudo borea* 0. 27. *Fixa ibidem* 00.0′$\frac{1}{2}$. *horoſcopus* ♏ 27. *propterea Luna in nonageſimo, paulo antea, Eclipticæ , boreali parte obſcuri limbi abſcondet ſtellam.*

Aprilis
d. h. ′
13.6.45. *Nondum ſubducto Horizonti noſtro ſole, Lunæ Præſepi* ♋ *junctæ latitudo vera* 1°-51′.*Sept. Præſepis* 1°-14′.*Horoſcopus* ♎ $29^{gr.}$ *Ergo Luna in Nonageſimo limbi obſcuri boreali quadrante conteget nebuloſas.*

Junii
d. h. ′ ° ′ ° ′
6.8.31. *Luna in* ♋ 25 0. *latitudo* 2. 5. *Sept. Fixæ ibidem latitudo* 1°-15$\frac{1}{2}$. *punctum oriens* ♐ 28. *Propterea Luna poſt horam* 9^{am} *medio obſcuri limbi conteget ſtellam.*
h. ′ ° ′ ° ′
8.10 51. *Luna in* ♌ 25. 52. *latitudinem habet* 0-40. *Auſt. Stella* 1°-25′.*etiam Auſtralis.Oritur tunc* ♒ 15:*propterea Lunæ deſcendentis limbus ſi non attinget ſtellam, eam tamen quam proximè aſſequetur.*
h. ′ ° ′ ° ′
9.11.21. *Luna in* ♍ 10. 21. *habet latitudinem* 1-50. *Auſt. Fixa* 2°-29′. *Oritur* ♓ 3$\frac{1}{2}$. *Propterea Luna deſcendens ſtabit infra* ✳^{am}.
h. ′ ° ′ ° ′
21.15.21. *Luna cum Fixa in* ♒ 13 8. *latitudo* 0-28. *Auſt. Fixa* 1°-16′. *item Auſt. Horoſcopus* ♋ 4$\frac{1}{2}$. *Ergo Luna poſt ſemihoram medio limbi lucidi abſcondet ſtellam.*
h. ′ ° ′
29.18.00. *Lunæ cum lucida Pleiadum latitudo* 5-10. *horoſcopus* ♌ 9. *Propterea oriente ſole borealiores inter eas poteſt contegere.*

Julii
d. h. ′ ° ′ ° ′
19.14.11. ☽^{x} *in* ♒ 21-17. *latitudo Sept.* 0-19. *Fixæ latitudo in eodem loco* 0°-10′. *Auſt. Horoſcopus* ♋ 12. *Deinde poſt* 22′. *temporis Luna cum ſequenti ſtella, cujus locus* ♒ 21-28. *Lat.* 0°-14′. *A. Quamobrem circa hor.* 15. *Luna contiguas fixas parte limbi boreali conteget.*
h. ′ ° ′
27.16.57. *Luna cum Fixa in* ♊ 3-35. *latitudinem obtinet* 5-4. *Sept. Fixa* 3°. 57′. *Oritur tunc* ♌ $19^{gr.}$ *Luna tranſit ſupra ſtellam, cui proximè appropinquat, circa* 16 *hor.*

Auguſti
d. h. ′ ° ′ ° ′
22.12.11. *Luna in* ♉ 13-58. *cum latitudine boreali* 5.12. *Fixæ cum ea latitudo* 4-8. *B.Horoſcopus* ♋ 14.*Propterea circa horam* 10$\frac{1}{2}$ *p. m. Auſtrali parte limbi lucidi abſcondet Fixam.*

23. 8^{h}-53'. *Luna cum lucida Pleiadum in* ♉ 25°. 25'. *cum latitud. Sept.* 5°-12'. *Horoſcopus* ♉ 22°. *Quamobrem Luna tunc exorta ſtellas Pleiadum præteriit; à quibus tamen medico intervallo, tubis facilè capacioribus dimetiendo, diſtabit.*

27. 15^{h}-17'. *Lunæ in* ♋ 25-0. *latitudo vera borea* 2°-2'. *Fixæ cum ea latitudo* 1°-15'. *Horoſcopus* ♌ 20. *Ergo circa horam* 13½ *p.m. Luna fixam occultabit in Auſtrali parte limbi lucidi.*

Septembris

19^{d}. 14^{h}-24'. *Luna erit in* ♉ 25°-25'. *cum* 5°-01'. *latitud. ſeptentrionali: Oritur tunc* ♌ 27. *Lunæ propterea in nonageſimo limbus Auſtrinus borealiores teget Pleiadum, qui tunc tamen à media & lucida* 15 *min. ad boream diſtabit.*

Octobris

9^{d}. 11^{h}-31'. *Lunæ in* ♒ 21°-28'. *latitudo borealis* 0°-33'. *Fixæ cum ea latitudo* 0°-14'. *Auſtr. Horoſcopus* ♌ 9. *Quamobrem Luna circa horam* 12½ *fixam hanc, & huic contiguam, paulo ante occaſum ſuum, Auſtrino limbo teget.*

17. 11^{h}-21'. *Luna in* ♊ 3°-35'. *ejus latitudo* 4. 42. *Sept. Fixæ cum ea latitudo* 3-57. *Horoſcopus* ♌ 12. *Quamobrem circa horam* 10. *eam in Auſtrali parte lateris lucidi abſcondet.*

Novembris

12^{d}. 9^{h}-49'. *Luna in* ♉ 13°-58'. *latitudinem habet* 5 0. *Sept. Fixa cum ea* 4°-08'. *Sept. oriente* ♌ 14⅔. *Luna propterea, tunc in ipſo Nonageſimo ſita, vel fixam auſtrino limbo teget, vel modico ab ea intervallo diſtabit.*

13. 5^{h}-56'. *Luna lucidæ Pleiadum verè juncta latitudinem habet veram borealem tantùm* 4°-52'. *Horoſcopus tunc* ♋ 2. *Propterea in Auſtrali corporis ſui ſemicirculo* medam lucidam *abſcondet Luna, in boreali* borealiores. *Appulſus* 1^{æ} *circa ſolis occaſum, cæteris ſubinde ordine conſpiciendus.*

Decembris

10^{d}. 16^{h}. 0'. *Rurſus Luna cum lucida Pleiadum, latitudinem obtinet* 5°. 0'. *Sept. Horoſcopus* ♏ 11°. *Quamobrem Luna mox occidentalem ſubteget, &, paulo ante occaſum, lucidam.*

11. 6^{h}. 6'. *Lunæ in* ♊ 3°-35'. *latitudo Sept.* 4°. 43'. *Fixæ cum ea* 3°-57'. *Horoſcopus* ♋ 7. *Luna ergo circa* 5^{h}. *medio corpore ſtellam teget.*

13. 10^{h}. 41'. *Luna in* ♋ 5. 23. *latitudo vera* 2. 54. *Sept. Fixæ* 2°-11'. *Horoſcopus* ♍ 17°. *Quamobrem Luna plena paulò poſtea ſtellam occultabit medio Auſtralis ſemicirculi.*

Reliquorum

Reliquorum quinque planetarum ad Fixas Appulſus, eodem Anno 1673 obſervabiles; ab iiſdem J. Heckeri *Ephemeridibus deducti à* J. Flamſtead.

	d.	*Hor.*	*Planetarum loci.*	*Latitud. planet.*	*Diſtantiæ a fixis in Longitud.*	*In Latitud.*
Jan.	6	6 *veſper.*	♂ *in* ♈^{s} 22°-59′	0°. 36′ *B.*	13′ *in ant.* 20^{e}.♈^{is} *cum*	1° — 2′ *ad Auſtr.*
		6 *veſper.*	♀ *in* ♓ 0--09	1 — 33 *Au.*	44 *in ant.* 15 ♒^{ii} *cum*	0 — 23 *Auſtr. ab ea*
	13	6 *veſper.*	♀ ♓ 7--30	1 — 23 *Au.*	25 *in conſ.* 23 ♒ *cum*	1 — 03 *Auſtr.*
	15	6 *veſper.*	♀ ♓ 9--58	1 — 20 *Au.*	3 *in ant.* 24 ♒ *cum*	0 — 04 *Borea.*
	17	6 *veſper.*	♀ ♓ 12--25	1 — 16 *Au.*	14 *in ant.* 25 ♒ *cum*	0 — 16 *Auſtr.*
Febr.	4	6 *mane*	☿ ♒ 0--30	1 — 04 *B.*	8 *in ant.* 6 ♑	0 — 16 *Bor.*
	5	6 *veſper*	♂ ♉ 10--36	0 — 57 *B.*	*cum ſtella* 13 ♈^{tis}	0 — 10 *Auſtr.*
	7	6 *mane*	☿ ♒ 2--43	0 — 23 *B.*	24 *in ant.* 10 ♑	0 — 08 *Bor.*
	8	6 *veſper.*	♂ ♉ 12--28	0 — 58 *B*	5 *in conſ.* 12 ♈^{is}	0 — 14 *Auſtr.*
	13	6 *veſper.*	♀ ♈ 15--01	0 — 03 *B.*	20 *in ant.* 13 ♓^{um}	0 — 54½ *Auſtr.*
	14	6 *veſper.*	♂ ♉ 16--12	1 — 01 *B.*	4 *in ant.* 9 ♈^{tis}	0 — 44 *Auſtr.*
Martii	6	6 *veſper.*	♂ ♉ 28--40	1 — 09 *B.*	12 *in ant.* 24 ♈^{is}	0 — 03 *Auſtr.*
	7	6 *veſper.*	♀ ♉ 10--34	1 — 29 *B.*	2 *in ant.* 13 ♈^{is}	0 — 22 *Bor.*
	8	6 *veſper.*	♀ ♉ 11--42	1 — 33 *B.*	41 *in ant.* 12 ♈^{tis}	0 — 21 *Bor.*
	9	6 *veſper.*	♀ ♉ 12--50	1 — 37 *B.*	27 *in conſ.* 12 ♈^{is}	0 — 25 *Bor.*
	12	6 *veſper.*	♀ ♉ 16--11	1 — 49 *B.*	5 *in ant.* 9 ♈^{tis}	0 — 03 *Bor.*
	14	6 *veſper.*	♀ ♉ 18--55	1 — 57 *B.*	27 *in ant.* 11 ♈^{tis}	0 — 39 *Auſtr.*
	14	6 *veſper.*	♂ ♊ 03--41	1 — 11 *B.*	2 *in conſ.* 23 ♉^{i} 14 *in ant.* 22 ♉^{i}	0 — 36 *Bor.* 0 — 07 *Bor.*
	16	6 *veſper.*	♀ ♉ 20--58	2 — 05 *B.*	5 *in conſ.* 26^{x} *Aurigæ*	0 — 27 *Auſtr.*
	18	6 *veſper.*	♃ ♎ 13--38	1 — 36 *B.*	*cum ſtella* 9^{a} ♍^{s}	0 — 09 *Auſtr.*
	20	6 *veſper.*	♂ ♊ 7--27	1 — 12 *B.*	9 *in ant.* 20 ♉^{i}	0 — 32 *Bor.*
Aprilis	10	7 *veſper.*	☿ ♉ 16--39	1 — 41 *B.*	23 *in conſ.* 9 ♉^{i}	0 — 05 *Auſtr.*
	12	7 *veſper.*	♃ ♎ 10--33	1 — 35 *B.*	3 *in conſ.* 8 ♍	0 — 48 *Auſtr.*
	14	7 *veſper.*	♂ ♊ 23-- 7	1 — 16 *B.*	11 *in conſ.* 27 *Aurigæ*	0 — 10 *ad Bor.*
	17	8 *veſper.*	♀ ♊ 23--28	3 — 34 *B*	30 *in ant.* 24 *Aur.*	0 — 32 *ad Auſtr.*
	18	8 *veſper.*	♀ ♊ 24--22	3 — 35 *B.*	23 *in conſ.* 24 *Aur.*	0 — 31 *Auſt.*
Maii	10	8 *veſper*	♂ ♋ 9--24	1 — 16½ *B.*	14 *in ant.* 21 ♊^{orum}	0 — 14 *Auſt.*
	11	8 *veſper.*	♂ ♋ 10-- 1	1 — 16½ *B.*	23 *in conſ. dictæ fixæ*	0 — 14 *Auſt.*
	16	8 *veſper.*	♀ ♋ 14--14	2 — 43 *B.*	5 *in ant.* 8^{a} ♊^{rum}	0 — 13 *Auſt.*
	28	4 *mane*	♄ ♈ 13--26	2 — 31 *B.*	♄ *cum fixa* 14^{x} ♓^{um}	1 — 0 *Auſt.*
Junii	4	8 *veſper.*	♂ ♋ 25-- 1	1 — 15 *B.*	1 *in conſ.* 8^{x} *Cancri*	0 — 0½ *Auſt.* ✳
	10	8 *veſper.*	♂ ♌ 2--33	1 — 13 *B.*	15 *in ant.* 1^{x} *Cancri*	0 — 1 *Auſt.*
Julii	28	8 *veſper.*	♃ ♎ 13--38	1 — 10 *B.*	♃ *cum ſtella* 9^{a} ♍^{s}	0 — 35 *Auſt.*

	d.	Hor.	Planetarum loci.	Latitud. planet.	Diſtantiæ à fixis in Longitud.	In Latitud.
						° '
Aug.	17	4 mane	♀ ♋ 18'-50'	3°. 37' Au.	16' in ant. 27^{e} ♊^{rum}	0—11 Bor.
	18	4 mane	♀ ♋ 19--42	3—31 Au.	36 in conſ. 27 dictæ	0—17 Bor.
	26	5 mane	♀ ♋ 27--0	2—44 Au.	14 in conſ. 10 Cancri	0—26 Auſtr.
Sept.	5	5 mane	♀ ♌ 6--48	1—40 Au.	1 in ant. 12 ♋^{i}	0—14 Bor.
	12	6 mane	♃ ♎ 22--14	1—00 B.	3 in conſ. 17 ♍^{s}	0—41 Auſtr.
	20	6 mane	♀ ♌ 22--38	0—26 A.	7 in ant. 10^{e} ♌^{s}	0—26 Auſtr.
	22	6 mane	♀ ♌ 24--48	0—16 A.	30 in ant. Cordis ♌^{s}	0—42 Auſtr.
	23	6 mane	♀ ♌ 25--54	0—12 A	36 in conſ. Cordis ♌^{s}	0—38 Auſtr.
	28	6 mane	♀ ♍ 1--31	0—11 B.	18 in ant. 15^{a} ♌^{s}	0—03 Bor.
Octob.	1	6 mane	☿ ♎ 0--21	1—37 B.	4 in conſ. 6 ♍^{s}	0—12 Bor.
	5	6 mane	♀ ♍ 9--27	0—40 B	32 in ant. 38 ♌^{s}	0—40 Auſtr.
	6	6 mane	♀ ♍ 10--36	0—43 B.	37 in conſ. dictæ ſtellæ	0—37 Auſtr.
	11	5 mane	☿ ♎ 13--40	1—57 B.	2 in conſ. 9 ♍^{s}	0—12 Bor.
	13	5 mane	♀ ♍ 18--39	1—06 B.	17 in ant. 11 ♌^{s}	0—50 Bor.
	16	5 mane	♀ ♍ 22--10	1—15 B	23 in ant. 5^{a} ♍^{s}	0—32 Bor.
	23	6 mane	♀ ♎ 00--29	1—32 B.	13 in conſ. 6^{a} ♍^{s}	0—07 Bor.
	29	6 mane	♃ ♏ 2--15	1—03 B.	7 in ant. 24 ♍^{s}	0—31 Bor.
	31	6 mane	♀ ♏ 10--04	1—47 B.	22 in conſ. 1^{a} ♎^{a}	0—08 Bor.
Novem.	3	7 mane	♂ ♍ 2--27	0—32 B.	4 in conſ. 24^{a} ♍^{s}	0—00½ B. verſus ✱
		etiam	♀ ♎ 13--38	1—50 B.	cum fixa 9^{i} ♍^{s}	0—05 Bor. ✱
	5	7 mane	♃ ♏ 4--00 ♂ ♏ 3--47	1—01 B. 0—31 B.	♃ in conſeq. ♂^{tis} 13' ☌	0—30 Borealior.
	10	6 mane	♀ ♎ 22--05	1—55 B.	6' in ant. 17^{a} ♍^{s}	0—10 Bor.
	15	6 mane	♂ ♏ 10--33	0—25 B.	1' in conſ. 1^{a} ♎^{a}	0—01 Auſtr. ✱
	23	6 mane	♃ ♏ 7--43 ♀ ♏ 8--00	1—02 B. 1—52 B.	♃ à ♀ . 53' circ. ♀	0—50 Borealior.
	24	7 mane	♂ ♏ 9--17	1—51 B.	26' in ant. 2^{a} ♎	0—04 Auſtr.
Decemb.	8	6 mane	♂ ♏ 26--21	0—12 B.	16 in conſ. 12 ♎	0—05 Bor.
	10	6 mane	♃ ♏ 10--33	1—03 B.	1 in conſ. 1^{a} ♎	0—37 Bor.
	11	6 mane	♀ ♐ 0--16	1—28 B.	11 in conſ. 5^{e} ♏^{ii}	0—14 Auſt.
	12	6 mane	♂ ♏ 29--05	0—10 B.	♂ cum fixa 6^{a} ♏^{ii}	1—04 Auſt. ✱
	24	7 mane	♀ ♐ 16--30	0—58 B.	14 in ant. 27 Ophiuchi	0—34 Auſtr.
	26	7 mane	♀ ♐ 19--00	0—54 B.	22 in conſ. 30 Ophiuchi	0—04 Auſt. ve

Stellæ Jovis *in Ephemeride aſſignati loci deficiunt hoc anno* 13'. *ab iis quos cælitus obſervavimus : propterea ejus omnes ad Fixas appulſus ante duos & amplius dies quam conſignantur obſervari poſſunt. At in* ♂^{tis} *&* ♀^{is} *ad eum applicationibus, eadem* 13 *min. ipſius loco adjeci ; ut, ſi aliquid à deſcripta Planetarum poſitione obſervata diſſentiat, in illorum ſolis locis peccare Ephemerides credantur.*

Sic omnes majorum Planetarum ad Fixas appulſus, Tubo Optico gradum unum recipiente, obſervabiles, brevi tabellâ complexus ſum. Ne nos ulla obſervandi prælaberetur opportunitas impræviſa, curæ fuit. Veſtrum dehinc, fidi Cæliſpices, fuerit, ne harum ulla neglecta pereat : Ab his enim accuratè ſi tandem fixarum loci reſtituantur (quod plurimum deſideratur,) optime veri planetarum motus cognoſci, reſtitui, & cœlis annuentes tabulæ conſtrui poſſunt : quod in votis habet

Cælorum & Cæliſpicum
Aſſiduus Cultor

J. F.

An Accompt of ſome Books.

I. *Proſe de Signori Academici di* Bologna; *in Bologna,* 1672 *in* 4°.

THis is a Complex of 15. Diſcourſes, at ſeveral times made by ſeveral perſons of the Illuſtrious Academy of *Bologna,* publiſh'd under the Preſidentſhip of the Noble Count *Valerio Zani.* Though theſe diſſertations be all ingenious and learned, each in their kind; yet we ſhall here chiefly take notice of the laſt of them (as moſt ſutable to the deſign of theſe Tracts,) compoſed by the Excellent Signor *Montanari,* concerning the admirable Changes and other Novelties obſerv'd in the Heavens. Touching which ſubject the Author ſcruples not to affirm againſt the fond Maintainers of the Immutability and Incorruptibility of the Celeſtial Bodies, that there is not one Conſtellation, which ſerveth not for an Inſtance of wonderful Novelties and frequent Changes, either by the Acceſſion of New Stars not diſcover'd before, or by the Extinction of ſome of thoſe that had been obſerv'd formerly, or by increaſe of Light in ſome, or the diminution of it in others. In the proving of this Aſſertion he is very particular; yet ſo that he referrs the Reader to a large Treatiſe, he is now preparing under the Title of the INSTABILITIES of the FIRMAMENT; not doubting but that he ſhall make it out to the Aſſertors of the *Incorruptibility* of theſe Viſible Heavens, that even in the Stars anciently deſcribed there are obſerv'd ſuch Changes, as would be ſufficient to make *Ariſtotle* himſelf, if alive, change his opinion in this point.

Amongſt the many particulars, in which this Author inſtanceth to make good his Affirmation, ſuch as are the Conſtellations of *Andromeda, Perſeus, Urſa, Draco,* and almoſt all the Northern ones, he noteth, that, having of late years found a conſiderable diverſity in the *Pleiades,* and the numerous Stars there-about, from them as they were deſcribed by *Galilei,* he hath taken the pains of deſcribing them anew by a Teleſcope of 20 palmes, (that is, about 13½ foot,) and exhibited them in this very Tract.

Nor does he doubt, but theſe Changes in the Fixt Stars have been frequent in other times; unregarded therefore becauſe it ſeem'd to men too abſurd, that ſuch glorious parts of Nature, as the Heavens and Stars are, ſhould alſo be ſubject to ſuch viciſſitudes and alterations; as if the manifold Wiſdom and Power of the Great Creator and Supream Governor of the Univerſe did not as well ſhine forth from the one, as the other.

If it be objected, that the Appearance and Diſ-appearance of thoſe Stars may be aſcribed to their Elongation from, and Proximity to our Eyes: He anſwers, *firſt*, That of all the Celeſtial Motions there being obſerv'd none but what are Circular or at leaſt approaching to Circular, if we ſhould think ſo of the Fixt Stars that appear anew, then the Plane of that Circle being over the Plane of our Eye, the Upper part of that Circle muſt needs be remoter from the Lower part, for Stars of the ſecond Magnitude, more than ſix times at leaſt; that is to ſay, that the Star in diſappearing to our Eye muſt be removed at leaſt ſix times farther off than when it appeared brighteſt: In which caſe we muſt needs ſee that Star move in an apparent ſtraight line, or in an Arch of a great Circle of above 19 degrees; which is moſt contrary to all Obſervation, by which it is notorious, that none of them do recede from their apparent firſt place. *Secondly*, That not only in the lately mention'd *Hypotheſis* of the Circle, but alſo ſuppoſing the Motion of ſuch Stars through a ſtraight line paſſing directly over our Eye, the ſaid diſtances of thoſe Stars, ſix times multiplyed by us, would not be ſufficient to ſalve the *Phænomenon* of being ſeen for a determinate time, and then to diſappear; but it would be requiſite to ſuppoſe in a manner an infinite profundity of the Stellar Sphere: an Exorbitancy not to be admitted, where no other reaſon urgeth to do it than the ſalving of ſuch Appearances. All which he largely explaineth in his diſcourſe; concluding it with a Conſideration, which imports, that, ſince Aſtronomers do now generally agree, that the

Fixt Stars are, like the Sun, enobled with their own native Light, he ſees no inconvenience in it to affirm, that they muſt alſo be ſubject to the incurſions of ſuch Spots, as the Sun is, which frequently augmenting about them do obſcure, impair, or quite abſcond their Light, & that ſometimes for a long, ſometimes for a ſhort time, & by turns, according as the matter, of which they are made up, gathers together in great or ſmall quantity. And therefore if ſuch bodies upon a ſudden meet about any Star, which for many ages, being free from ſuch darkning matter, did ſhine very bright to us, what wonder, it ſhould be obſcured, or vaniſh altogether? Again, if any Star, which before had alwaies about it ſuch a quantity of Spots, as that for a long time it was counted to be (for example) of the fourth Magnitude, do unexpectedly unvail its face, it will then ſhine forth and challenge poſſibly the place of a Star of the ſecond or firſt Magnitude: Again, if any Star, having been for many ages confin'd to a dark priſon among theſe Spots, do break Priſon and ſhow its formerly reſtrain'd Light; what wonder, if there appear to us a New and never before ſeen Star? And if by a new collection of Spots it return to its former impriſonment; what wonder, if we loſe again the Splendor of it? Laſtly, if one only part of the body of any Star lets out its internal luſtre, and have a periodical motion about its own Center; you'l ſee it, no leſs than that of Bullialdus's in the *Whale*, appear at certain determinate times, untill a new maſs of collected Spots, or a new Opening of the ſame do occaſion an unexpected alteration.

Theſe our Author propoſes as *Poſſible* Cauſes of ſuch Effects; remitting thoſe, that require *Indubitable* ones, to that of *Lucan* Pharſal. l. 1.

> *Quærite quos agitat Mundi labor; at mihi ſemper*
> *Tu, quæcunque moves tam crebros* Cauſa *meatus,*
> *Ut Superi voluere, late*―――

So much of this Exercitation, which we conſider as moſt proper for our purpoſe. As for the others, we ſhall but name ſome of them, *viz.* Of all ſorts of Equeſtrian Games and Exerciſes; of all ſorts of Baths,, and the various Entertainments therein, of the ſeveral Sects of Philoſophers, and the Genuin Method of Philoſophiſing, here eſteem'd to be the Experimental way; of the Phyſical Cauſes of the reputed Sympathies and Antipathies of things; of Muſical Intervals, and of Muſick in general; of Moral Philoſophy, *&c.*

II. *Relation de divers Voyages Curieux*, *IV Partie. A* Paris, 1672. *in fol.*

THis Fourth part of the Curious Voyages of the worthy M. *Thevenot* is as yet but begun, there being only printed of it and tranſmitted to us two Diſcourſes, the *one* containing a Pourtraiture of the *Indians* by D. *Juan de* Palafox, Biſhop *de la Puebla de los Angelos*; the *other* being a Relation of the Voyages of N. N. into the River *della Plata* and from thence over Land into *Perou.*

Concerning the former, the ſaid Biſhop having in *New-Spain* for ſeveral years exerciſed the Charge of Viſitor and Vice-Roy as well as Biſhop, and thereby acquired a perfect knowledg of the evils, which thoſe *Indians* were made to ſuffer, he preſented this diſcourſe to *Philip* IV. King of *Spain*, to acquaint him with the Innocence of thoſe people, the ill treatment they lay under, and the remedies that might be adminiſtred for it.

In deſcribing their nature and manners, he affirms, that there can hardly be any people more humble, more gentle and leſs intereſſed; that never are idle, but alwaies employed by the Strangers ſet over them; that know no Envy; that are very chaſt except when overtaken with drink, which they are the more ſubject to, becauſe they eat but little. Though they are good natured and ſeemingly innocent, yet, *ſaith he*, they want no wit; of which he alledgeth many Examples: Among others praiſeth the ſagacity, by which one of thoſe *Indians* convinced a *Spaniard* to have ſtollen his Horſe. For, when that *Indian* ſaw that the Judge, what pains ſoever he took in examining the accuſed party, could find no proof of the Theft, he threw his cloak over the ſtolne Horſes head, asking the Theif, of what Eye the Horſe was blind? The thief, being puſled, and yet unwilling to appear mute, anſwer'd at random, of *the right Eye*. Whereupon the *Indian*, uncovering the Horſes head, ſaid; 'Tis plain, the Horſe is none of thine, for thou knoweſt not, that he is neither blind of the right nor of the left Eye.

Beſides, he taketh notice, that there are good Muſitians amongſt them, that manage their voyce well; that play on all ſorts of Inſtruments, and ſound a Trumpet very well; that have Muſick-books in their Chappels, and Maſters of Muſick in all the Parochial Churches.

Further, he tells us, that they are very dextrous in cutting and poliſhing Pretious-ſtones, of which alſo and their virtues they are ſaid by him to be very skilful; as they alſo are of the virtues of Plants, whence they draw good and very ſuccesful remedies againſt many diſeaſes and infirmities.

Again, he commends both their dexterity and courage, in that they caſt themſelves ſtark naked into the water, and getting upon the back of a Crocodile, take the opportunity, when the Beaſt opens his throat, to put a ſtick of half an Ell long betwixt his teeth, and ſo draw him with a cord, tyed to the ſtick, a ſhore, *&c.*

The *other* Diſcourſe is made by one *Acarete* a *Biſcayan*, who having ſailed A. 1657. from *Cadiz* to *Buenes-ayres* in the Southern *America*, about the Mouth of the River *dela Plata*, was ſent from thence over Land into *Perou*, which is above 400 Leagues; in which Voyage he made many not contemptible Obſervations. He ſtay'd ſome time at *Potoſi*, where he ſaw the Silver-and-Gold-*M*ines, and aſſiſting at the magnificent ſolennity celebrated for the Birth of the Prince of *Spain*, he was an Eye-witneſs, that the Streets, where the Proceſſion paſs'd, were paved all along with barres of Silver.

He deſcribes very exactly the Countries of *America*, he paſs'd through; noting the Scituation of the places, the Animal nimals and Plants to be found there, the Temperature of the Air, the Manners of the Inhabitants, their number, their wealth, and the commodities they trade in.

He obſerves, that about the Upper part of the river *Urugais*, towards *Parana* and the Province of *Paraguais*, there are rich Gold-mines, diſcover'd by *Jeſuites*; of which the Gold is much finer than that of *Perou*.

In the ſame Province grows an Herb call'd Herb of *Paraguais*, ordinarily given to the Mine-men afflicted by the Sulphureous and other damps of the Mines, who are recover'd by drinking the decoction thereof, which makes them vomit up with great eaſe whatever troubles their ſtomack.

In the way from *Buenos-ayres* to *Perou*, about S. *Jago del Eſtro*, as he met with Tigers very fierce, ſo he found the Lyons very gentle. About the ſame place he found thoſe Animals call'd *Guanacos*, as big as Horſes, with long necks, little heads, and ſhort tayls; having in their ſtomack the *Bezoar*-ſtone.

Speaking of the *Oſtriches* abounding in that Country, he relateth a remarkable thing, which he ſaith he hath ſeen, *viz.* That, when that Bird is hatching her Eggs, and they are ready to hatch, ſhe breaks four of them and carries them to the four corners of the place ſhe is hatching in: which Eggs thus broken coming to corrupt, there is in a little time bred out of them a great quantity of worms, with which the young ones, when hatched, are fed untill they are able to go and ſeek for their food elſewhere, *&c.*

Errata in this Tract.

P. 5108. l. 2. r. *March* for *Febr.* p. 5115. l. 7. r. *Phænomena.*

LONDON,

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PHILOSOPHICAL TRANSACTIONS.

Januar. 20. $16\frac{72}{73}$.

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SIR,

WE have formerly given you certain reaſons for the Exiſtence of *Veins*, (analogous to thoſe in Animals) in all Plants whatſoever, not Muſhromes excepted : To which we might add others of later notice ; as the skin of a plant may be cut ſheer off with part of the ſpongy *parenchyma*, and no ſigns of Milky juice follow, that is, no breach of a vein. Again, we have ſtript the Plant of its skin, by pulling it up by the roots, and expoſing it to the wet weather, untill it became flaccid as a wet thong, without any injury to the Veins, which yet upon inciſion would freſhly bleed. Theſe Experiments, I ſay, make againſt the general opinion of one only ſap looſely pervading the whole plant, like water in a ſponge.

And though we have made theſe and many other Experiments to facilitate an ocular demonſtration of theſe Veins ; yet we have not been able to effect it to our mind, and ſubject them as nakedly to our eye as we could wiſh, for a through-information of their Uſe, and a minute and accurate diſcovery of all the particular Accidents belonging to them as ſuch veſſels. This, I ſay, is a work of much labour and patience ; and that which renders matters very difficult, is the infinite number, ſmallneſs and perplexity of theſe Plants.

In the Tranſverſe cuts of Plants, we ſee as it were a certain Order and Number of the bloody orifices of diſſected veins. We obſerve alſo in a Leaf, which we take to be the ſimpleſt part of a plant,

1. That the Veins keep company with the Ribbs and Nerves (as we vulgarly call them,) and are diſtributed into all the parts of the Leaf, according to the ſubdiviſions of thoſe nervous lineaments, and are diſpoſed with them into a certain net-work ; whether by Inoſculations or bare contact only, we pretend not to determine.

2. That in a Tranſverſe cutt of a Leaf, the middle Fibre or nerve, for example, ſeems to yield one big drop of a Milkie juice, ſpringing as it were from one vein ; yet the Miſcroſcope plainly ſhews us, that there are many veins which contribute to the making up of that drop.

3. That if a Fibre or nerve be carefully taken out of the Leaf, the Veins will appear in it like ſo many ſmall hairs or pipes running along and ſtriping the nerve.

4. That thoſe many veins are all of an equal bigneſs, for ought we have yet diſcerned to the contrary.

5. That though we ſeem to be more certain of the ramifications of the Fibres, wherein thoſe veins are, we yet are not ſo, that thoſe veins do any where grow leſs and ſmaller, though probably it may be ſo. That which makes us doubt it, is the exceeding ſmallneſs of theſe veins already, even where we might probably expect them to be Trunk-veins and of the largeſt ſize ; and being there alſo in very great Numbers and running in direct lines along the fibre, we gueſs, that one or more of them may be diſtributed and fall off on either hand with the ſubdiviſions of the fibres, and not ſuffer any diminution in their bulk.

6. That we cannot diſcern any where throughout the whole plant larger or more capacious veins, than thoſe we ſee adhering to the fibres of the Leaves ; which do alſo appear from comparing the bleeding Orifices in a tranſverſe cutt. I have found it a difficult and laborious task, to trace and unravel them throughout the whole plant.

Our opinion is, that theſe Veins do ſtill keep company with their reſpective Fibres. And as all the Fibres of the Leaf are joined in the Stalk of the Leaf, and that ſtalk explicated in cloathing the Twig or Stem of the plant, (which we take to be the reaſon of the orderly breaking forth of the Leaves,) ſo do we think of the Veins, their perpetual companions. And, as we have ſaid, the Fibres of the Leaves are joined in the Twig; ſo are thoſe of the twigs in the Branches; thoſe of the branches in the Trunk or body of the tree: The like alſo in an inverted order we ſeem to obſerve in the ſeveral Coats and Ramifications of the Root. This the ſeveral Circles of bleeding Orifices in tranſverſe cuts ſeems to confirm.

But moreover in the Roots of plants, if a ſimple Coat be ſeparated and expoſed betwixt your eye and the light, the Veins appear to be ſtrangely intangled and implicate, and not in the ſame ſimple order as in the Leaves. The like we think of the Bark of the bodies of Trees, which we cannot diſtinguiſh from the Roots of plants; though there is, indeed, ſomething (at leaſt at certain ſeaſons of the year) in the Root, which is not to be found in any part of the plant beſides.

From what hath been ſaid, it may well be doubted, whether there is any *ſinus* or common Trunk, into which all the veins are gathered? But rather, that there are a multitude of equally big veins, each exiſting apart by it ſelf. We indeed have found it very difficult ſo to exhauſt the plant of its milkie juice, as to kill it, though we have given it very many inciſions to that purpoſe. Divers other inſtances there are, which favour the Diſcontinuance of the Veins, and the little relation and intercourſe they have with one another; as one branch of a Tree having fair and well grown fruit, before the other branches of the ſame tree and fruit bloſſom or have leaves; from the different ſituation and other circumſtances of culture; the indefinite and perpetual growth of a Tree; the Cyon governing, &c.

And thus far we have taken our information concerning theſe Veins, partly by the appearance they make in tranſverſe cuts, and partly by the help of a Microſcope; which laſt indeed has ſhewed us ſomething of their number, magnitude, order, diſtributions, &c. And yet neither of theſe helps in our hands has ſatisfactorily diſcovered to us other particulars belonging to theſe veſſels, as external Figure, Coats, Cavitie, &c.

The ſubſtance of theſe veins ſeems to be as truly *Membranous*, as the Veins of Animals: A Leaf will not give way and be extended, but the Veins in a leaf, if freed of all the woody Fibres, will be ſtretched out to one third part at leaſt, and vigorouſly reſtore themſelves again, juſt like a Vein, Gut, or any other membranous *ductus* of an Animal. Again theſe membranous Pipes are exceeding thin and tranſparent, becauſe they ſuddainly diſappear and ſubſide after their being exhauſted of their Juice; and particularly in that we ſee the liquor, they hold, quite through them, no otherwiſe than the blood through our Veins, or (in *Chelidonium majus*, for example) a tincture of Saffron in Cryſtalline Pipes.

Concerning the External Figure of theſe Veins and Cavitie, as well as other Accidents, we thought, they would have been made more apparent to us, if it were poſſible to coagulate the Juice they hold without much ſhrinking the plant. We were in great hopes, *Freezing* would have effected this; which though it did not ſucceed as we promiſed our ſelves, in reſpect of the manifeſtation of theſe Accidents; yet it gave us ſome further light into the nature of the Juice of theſe veins. In the keeneſt froſt, which hapned the other winter, we diſſected the frozen leaves of the *Garden Spurge*. Here we obſerved, that all the Juice (beſides that which theſe veins hold) was, indeed, frozen into perfect hard Ice, and to be expreſſed out in the figure of the containing pores; but the Milkie-Juice was as liquid as ever, but not ſo brisk as in open weather.

This Experiment we take to be good proof of the perfection of this Milkie Juice, and that it hath within it ſelf ſo great a degree of fermentation, that it preſerves it ſelf and conſequently the whole plant from the injuries of the weather; that is, the plant owes its life to it. Thus we have ſeen Inſects (as *Hexapode*-worms, &c.) ly frozen upon the ſnow into very lumps of Ice, which did not only cauſe the glaſs to ring we ſtruck them againſt, but did endanger the breaking of it: And yet, put under the glaſs and expoſed to the warmth of the fire, they quickly recovered their legs and vigour to eſcape; which we think could not be, unleſs the Vital liquor of their veins, as in this Inſtance of plants, had been untouched and little concerned in the froſt. Further, we hence alſo argue the different *Uſes* as well as *Natures* of theſe Juices, and look upon the frozen Icicles or that copious dilute and Limpid ſap as *Alimental*; the Milkie and not frozen Juice, as the only proper *Venal*.

As to the motion of theſe Juices, theſe things are certain;

1. That the *Milkie* Juice alwaies moves and ſprings briskly upon the opening of a vein; the *Limpid* ſap but at certain ſeaſons, and as it were by accident, and not (as I judge) from any vital principle or fermentation of its own.

2. The *venal* juice hath a manifeſt inteſtine motion or fermentation within it ſelf; witneſs (beſides what hath been juſt now ſaid of it) its contributing (and the long continuance of) that motion to the moſt inſenſible of liquors; and likewiſe its thick and troubled bleeding, like the riſing of yeaſt, which yet in a few hours after drawing falls, and the juice becomes tranſparent, as the Gum of the *Virginian Rhus*, &c.

I ſhall not deſire any perſon to acquieſce wholly in a bare fermentation; but endeavour a happy diſcovery of the Frame of *all* the parts of a plant, on which perhaps this motion may much depend. In the mean time we muſt indeed needs think (according to the knowledge we yet have of the parts of plants,) that theſe juices move by a far different contrivance of parts from that of Animals; not yet here diſcovering any uniting of veins into one common Trunk, no Pulſation, no ſenſible ſtop by ligature, no difference in veins, &c. All which difficulties notwithſtanding may, I hope, in time be happily overcome; and the Analogie betwixt Plants and Animals be in all things elſe, as well as the motion of their juice, fully clear'd.

There ſeem to be in Plants manifeſt Acts of *Senſe*. We inſtance in the ſuddain ſhrinking of ſome Plants; the frequent cloſing and opening of flowers; the critical erecting of the heads of Poppies from a pendulous poſture, and particularly the *Vermicular* motion of the veins when expoſed to the air. Again, the Veins of Plants may indeed be different, though at preſent we cannot tell wherein they are ſo. The Arteries within our heads are hardly to be known by the eye from the Veins. Further there are natural and ſpontaneous excretions or venting of ſuperfluous moiſture in plants, viſible and conſtant, in the *Crown Imperial*, *Rorella*, *Pinguicula*, &c. As to the Ligature, as it hath been hitherto applied by us, it is not to be relyed on for the diſcovery of this motion; the Veins only of plants being the parts probably diſtendable.

Laſtly we ſhall not omit to tell you, that either we muſt take that away from the other reaſons given of the neceſſity of the Circulation of the blood in Animals, *viz* the hindring of its breaking and clodding; or we muſt grant the ſame motion to the *Venal* juice in Plants: we having undeniable Experiments to ſhew, that the Venal juice of Plants and the *Blood* of Animals agree in this, that they both, when they are once drawn from their reſpective veins, do forthwith break and coagulate, and that the *ſerum* in the one as well as in the other becomes a ſtiff gelly by a little ſtanding.

But of the different natures of the juices of theſe veins in divers Plants and their motion we will remain your debtor, and acquit our ſelves when we ſhall find it convenient; at preſent only acquainting you, what variety of Experiments hath taught us, that probably more uſeful preparations and certainly a truer Analyſis and ſeparation of the parts of vegetable Drugs may be effected, whilſt they are in bleeding and liquid, than after they are once become concrete and have loſt their natural Fermentation.

I am, &c.

The

The Copy of a Letter from Somerſetſhire, *concerning a* Strange Froſt, *which hath lately done much hurt about* Briſtol ; *together with ſome uſeful hints ſuggeſted upon that occaſion.*

SIR,

I Have my ſelf obſerved, and heard from others, that much violent Rain fell in many places of *England* this laſt Summer and Autumn 1672. And 'tis manifeſt, that ſuch vehement ſhowers do waſh and carry away the Soil and richeſt Compoſt out of the common fields into the Rivers, and by them into the Ocean : Which is the cauſe of barreneſs and ſcarcity of Corn, and ſometimes of a great mortality of Men and Cattle in the following years ; as I could make appear by many ſad inſtances.

For a remedy againſt Famine,or to prevent it,ſome good Men, with much zeal for the publick welfare, have earneſtly ſollicited *The Plantation of Orchards and Groves* ; having received it from a Tradition pretending to long Obſervation and frequent Experience, that in thoſe years, in which Corn moſt fails, fruit, maſt,cheſnuts, wall-nuts, and ſuch relief from our Trees, do moſt abound. But there is no ſufficient defence againſt Divine Judgments, till we return to our duty. That Orchards and Groves will not do it, you may ſee by the *Narrative following* ;

The Freezing rain, which fell here the ninth, tenth, or eleventh of *December* laſt, (for I cannot confine the time exactly) hath made ſuch a deſtruction of Trees in all the Villages and High-ways from *Briſtol* toward *Wells* and towards *Shepton-Mallet*, and towards *Bath* and *Bruton*, and in other places of the Weſt, that both for the Manner and Matter it may ſeem incredible ; and is more ſtrange than I have found in any Engliſh Chronicle. You will have the proof and manner and beſt meaſure of it in a Tranſcript, which I ſhall here give you from a very worthy perſon of unqueſtionable credit, as you or others of your near acquaintance do well know.

“ *The late prodigious Froſt* (ſaith he) *hath much diſabled*
“ *many old Orchards expoſed to the North-Eaſt. Had it concluded*
“ *with ſome guſts of Wind, it might have been of ſad importance:*
“ *I weighed the Sprigg of an Aſh-tree of juſt three*
“ *quarters of a pound, which was brought to my Table; the Ice*
“ *on it weighed ſixteen pounds, beſides what was melted off*
“ *by the hands of them that brought it. A very ſmall bent at*
“ *the ſame time was produced, which had an Iſicle, encompaſſing*
“ *it, of five inches round by meaſure: Yet all this while, when*
“ *Trees and hedges were loaden with Ice, there was no Ice to be*
“ *ſeen on our Rivers, nor ſo much as on our ſtanding Pools. Now*
“ *we are ſeriouſly concerned for Replanting. Dated* Dec. 30. 72.

Sir, The like, or worſe and more ſtrange complaints, I received from ſeveral other places, and from Eye-Witneſſes of credit. Some Travailers were almoſt loſt by the coldneſs of the freezing air, and freezing rain. All the Trees, young and old, on the high-way from *Briſtol* to *Shepton*, were ſo torn and thrown down on both ſides the ways, that they were unpaſſable. By the like obſtructions the Carriers of *Bruton* were forc't to return back. Some were affrighted with the noiſe in the Air, till they diſcerned that it was the clatter of Icy boughs daſhed one againſt another by the wind. Some told me, that riding on the ſnowy Downs, they ſaw this freezing rain fall upon the ſnow, and immediately freeze to Ice, without ſinking at all into the ſnow; ſo that the ſnow was covered with Ice all along, and had been dangerous, if the Ice had been ſtrong enough to bear them. Others were on their Journey when the Ice was able to bear them in ſome places, and they were in great diſtreſs.

I ſaid, I could not punctually define the time when this freezing-rain was moſt violent and moſt apparent. *Dec.* 8. much ſnow fell here; the ninth, much rain fell here; and all the ſnow paſſed away, not leaving an Icicle amongſt us. The tenth day, we had ſuddain fits of cold and relaxing warmneſs. On Wedneſday (*Dec.* 11.) I ſaw a young man, who returning home from a Journey of five miles, and coming into a warm room, cryed out of extream torments in all parts of his body. He affirmed, that the Air, and the Winds (which were then ſomewhat high) were ſo unſufferably cold, that he was in utter deſpair of coming home alive; yet all that day nothing but moiſt dew fell under our feet. If we ſay, the Earth did ſend forth warm ſteams to keep this freezing rain diſſolved on her Surface; whence ſhall we ſay, the Air and Rain and Winds got theſe freezing Icicles, which oppreſſed men and plants? When the candid Froſts do cover our Fruit-trees perfectly white (as I have oft-times ſeen it hold for ſome weeks together) it is ſo far from doing hurt to the Trees, that we have it in a proverb for a good ſign of abundance of fruit in the enſuing year: But for this Freezing rain, as ſoon as it touched any bough, ſetled into Ice, and by multiplying and enlarging the Icicles (eſpecially where it could lay hold on Moſs or other aſperities of the Tree) it broke all down with the weight.

As ſoon as theſe Froſts were over, we had glowing heats, which cauſed a general complaint amongſt us of exceſſive ſweating, by night and day. The buſhes and many flowers in the Garden appeared in ſuch forwardneſs, as if it were in *April* or *May*. I ſaw young Coleworts growing; roots and leaves; on the top, leaves of an older Colwort. Not far from my abode, an Apple-tree bloſſomed before Chriſtmaſs: This I do not mention for extraordinary; but I think, 'tis more than ordinary, that before New-years-tide this Apple-tree bore Apples perfectly knitted, and as big as ones fingers end. I had ſome of theſe apples brought to me, which I intended to ſend you; but they ſo withered in my pocket, that they have little reſemblance of what they were a fortnight ſince, when they were green and plump.

It were to be wiſhed, that ſome ingenious men would (inſtead of the conjectures of weather to come) give a faithful and judicious accompt of the weather, and other remarkable accidents and phænomena, as they fell out on the ſame day of the Month of the year foregoing. Hence we might in time examine upon ſome grounds, How far the Poſitions of Planets, or other ſymptoms or concomitants, are Indicative of Weathers. Probably we may have forewarnings of Deaths or Famines, Epidemical diſeaſes, &c. and by their cauſes be inſtructed for remedies or prevention. Certainly, by this method we may learn more in few years than at random in all the days of our ſhort lives. And, if ſuch Calenders might be had from other forreign and remote parts, as from *Dantzick*, *Tangier*, *New England*, *Bermudos*, *Barbados*, *Jamaica*, &c; we ſhould make a cloſer chaſe to inveſtigate the cauſe of Heat and Cold, coaſting Rain and coaſting Winds. And this diligence would be profitable if obſerved from ſeveral parts of England, Sea-coaſts, Midland, &c.

Neither would it leſs oblige poſterity, if he, who writes the *London-Calendar*, would record at the end of every month the higheſt and loweſt price of Wheat, Rye, Barley, Peaſe, Beans, Oats, as they are ſold in ſome chief Market in *London*; and abſtract in one page the *weekly Bills* of Births, Burials, of Males and Females.

And the like Calenders are to be wiſht from *Paris*, *Rome*, *Venice*, *Vienna*, *Madrid*, ſince Major *Grant* hath drawn us good Inſtructions, what manifold uſes may be made from ſuch informations, &c.

It cannot be expected, that we ſhould ſoon have it regiſtred under every month, *the Quantity and Weight of Rain that falls every month*, or in great ſhowers, or long laſting rain. And though this would ſeem a dull work; yet it would ſignifie ſomething to ſome purpoſes.

In old Hiſtories I find, that Earthquakes, Inundations, Droughts, Famine, Peſtilences, were each of them (in their ſeveral ſeaſons, and ſometimes one cloſe on the heels of the other,) almoſt univerſal over the known world; ſometimes raging from place to place ſeveral years together. As the Learned *Meade* relateth of a Peſtilence, which in the days of *Gallus* and *Voluſianus* began in *Æthiopia*, and for

fifteen

fifteen years waſted all the Roman Provinces. *Zonaras* is his Author; and *Lipſius* his abettor in theſe words; *Nec alia unquam major lues mihi lecta, ſpatio temporum, ſive terrarum.* As plagues and famine, ſo ſtorms and tempeſts, and (as far as I could collect) this froſt, and ſome winds, (more in ſome places then in other) did run from one place, and break out in another at differing times and by ſhort journeys, about ten miles at a time. Thunder is not often heard above twenty miles off; except when it rolls about in a large compaſs, or the ſound is aſſiſted by the conveyance of Woods, Foreſts, Rivers or Channels. Hence Correſpondence will be neceſſary to perfect theſe Regiſters.

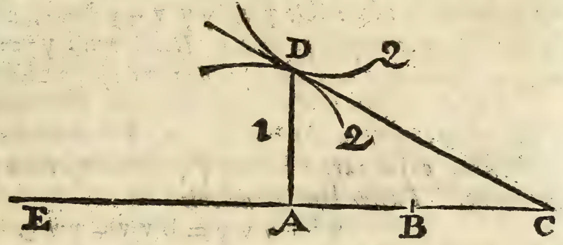
If ſuch a *Kalendar* as is here propoſed, were happily begun, the leading example would draw on and grow to afford us better Light, than hath been hitherto aſſured by all the remains of Aſtrology. And they may make acquaintance with others, who have a genius, imployment and opportunities fit to bear the trouble *of drawing the Tables* of Weather and remarkable fatalities. Forewarnings may prepare us to conſult for Preventions or Remedies. In the year 1629 or 1630 there was a Dearth in *England*: And much talk there was then, that in *London* they had a way to knead and ferment boyled Turneps with a ſmall quantity of meal; and that it made better Bread for whiteneſs, pleaſantneſs, laſting and wholeſomneſs, than is made of the fineſt flower or wheat. Turneps, Rapes, Carrets, Parſneps, Potadoes, and other Roots lye ſafe under ground from ſcorching heat, and are ſaid to thrive beſt in the greateſt rain. *Potadoes* were a relief to *Ireland* in their laſt famine. They yield meat and drink. But after all our diligence and contrivances, our only ſafeguard is, to ſerve him, that is the Supreme Governor and Diſpoſer of all.

Jan. 13. 16$\frac{72}{73}$.

An Extract of a Letter from the Excellent *Renatus Franciſcus Sluſius*, Canon of *Liege* and Counſellor to his Electoral Highneſs of *Collen*, written to the Publiſher in order to be communicated to the *R. Society*; concerning his ſhort and eaſie *Method of drawing Tangents to all Geometrical Curves* without any labour of Calculation: Here inſerted in the ſame language, in which it was written.

—*Methodum meam ducendarum ad Curvas quaſlibet Geometricas Tangentium mitto ad Te, & Virorum Doctiſſimorum* R. Societatis *cenſuræ ſubmitto. Brevis mihi viſa eſt ac facilis, quippe quam puer ἀγεωμέτρητος doceri poſſit, & quæ abſque ullo calculi labore ad omnes omnino lineas extendatur: Malo tamen aliis talem videri quàm mihi, cùm in rebus noſtris cæcutire plerumque ſoleamus.*

Fig. 1. *Data ſit igitur qualibet Curva DQ, cujus puncta omnia referantur ad Rectam quamlibet datam EAB per Rectam DA; ſive EAB ſit diameter ſeu alia qualibet, ſive etiam aliæ ſimul lineæ datæ ſint, quæ, vel quarum poteſtates Æquationem ingrediantur; parùm id refert.*



In Æquatione Analytica, facilioris explicationis causâ, DA perpetuò dicatur v, *BA*, y. *EB verò & aliæ quantitates datæ,* Conſonantibus *exprimantur. Tùm ſupponatur ducta DC, tangens curvam in D, & occurrens EB, producta, ſi opus ſit, in puncto C; & CA perpetuò quoque dicatur* a. *Ad inveniendam AC vel* a, *hæc erit* Regula Generalis;

1. *Rejectis ab æquatione partibus, in quibus* y *vel* v *non invenitur; ſtatuantur ab uno latere omnes in quibus eſt* y, *& ab altero illæ in quibus habetur* v, *cum ſuis ſignis* + *vel* −. *Hoc, dextrum, illud, ſiniſtrum latus, facilitatis causâ, vocabimus.*

2. *In latere dextro, præfigatur ſingulis partibus exponens poteſtatis quam in illis obtinet* v; *ſeu, quod idem eſt, in illum ducantur partes.*

3. *Fiat idem in latere ſiniſtro, præponendo ſcil. unicuique illius parti Exponentem poteſtatis quam in illa habet* y. *Sed & hoc amplius: Unum* y *in ſingulis partibus vertatur in* a.

Ajo, Æquationem ſic reformatam modum oſtendere ducendæ Tangentis ad punctum D datum. Cùm enim eo dato, pariter datæ ſint y *&* v, *& cæteræ quantitates, quæ Conſonantibus exprimuntur;* a *non poterit ignorari.*

Si quid forte ſit obſcuritatis in Regula,*aliquot exemplis illuſtrabitur: Data ſit hæc Æquatio* $by - yy = vv$; *in qua EB ſit* b; *BA*, y, *DA*, v, *& quæratur* a *ſive AC talis, ut juncta DC tangat Curvam DQ in D. Ex* regula, *nihil rejiciendum eſt ab hac Æquatione, cùm in ſingulis ejus partibus reperiatur* y *vel* v. *Ita quoque diſpoſita eſt, ut ab uno latere ſint omnes illius partes in quibus* y; *ab altero, omnes in quibus* v. *Singulis itaque tantùm præfigendus eſt Exponens poteſtatis, quam in illis habet* y *vel* v; *& in latere ſiniſtro unum* y *vertendum in* a, *ut fiat* $ba - 2ya = 2vv$. *Ajo nunc, hanc Æquationem oſtendere modum ducendæ Tangentis ad punctum D, ſive* $a = \frac{2vv}{b-2y} = AC$.

Sic ſi data fuerit æquatio $qq + by - yy = vv$; *eadem planè fieret cum priori Æquatio pro Tangente, abjecto ſcil.* qq, *ut Regula præſcribit. Sic ex* $2byy - y^3 = v^3$ *fit* $4bya - 3yya = 3v^3$ *ſive* $a = \frac{3v^3}{4by-3yy}$: *Ex* $bby + zyy + y^3 = qvv$, *fit* $bba + 2zya + 3yya = 2qvv$ *&* $a = \frac{2qvv}{bb+2zy+3yy}$: *Ex* $b^4 + by^3 - y^4 = qqvv + zv^3$, *fit* $3^6yya - 4ya^3 = 2qqvv + 3zv^3$ *&* $a = \frac{2qqvv+3zv^3}{3byy-4y^3}$.

Verùm in ſimilibus æquationibus nullam arbitror accidere poſſe difficultatem. Aliqua fortaſſe in illis occurret, quarum partes quædam conſtant ex productis y *in* v: *Ut* yv, $yyv - y^3vv$, *&c. Sed hæc quoque levis eſt, ut exemplis patebit. Detur enim* $y^3 = bvv - yvv$. *Nihil ab illa rejiciendum erit, cùm in ſingulis ejus partibus reperiatur* y *vel* v: *Sed ut ex Regulæ præſcripto diſponatur, bis ſumendum erit* yvv, *& ſtatuendum tam in latere dextro, in quo ſunt partes quæ habent* v, *quàm in ſiniſtro, cujus partes habent* y; *quandoquidem* yvv, *tam* y *quàm* v *contineat. Faciendum* ~~*igitur erit*~~

$$y^3 + vvy = bvv - yvv.$$

Tum mutatâ, ut priùs, hac æquatione in aliam $3yya + vva = 2bvv - 2yvv$; *dabitur* $a = \frac{2bvv-2yvv}{3yy+vv}$.

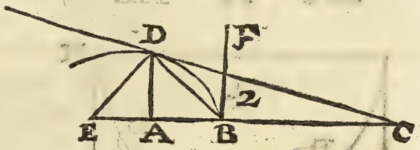
Ita enim intelligenda eſt Regula, ut nempe in latere non conſideretur poteſtas ipſius v, *ideoque ipſi* yvv *Exponens* vv *præfigi non debeat, ſed tantùm ipſius* y: *Sicut contra ab alio latere, in* yvv *conſiderari non debet poteſtas ipſius* y, *ſed* v *tantùm, eique ſuus Exponens præponi. Sic ſi foret* $y^5 + by^4 = 2qqv^3 - yyv^3$, *faciendum eſſet* $y^5 + by^4 + v^3yy = 2qqv^3 - yyv^3$; *& haberetur æquatio pro Tangente* $5y^4a + 4by^3a + 2v^3ya = 6qqv^3 - 3yyv^3$ *&* $a = \frac{6qqv^3-3yyv^3}{5y^4+4by^3+2v^3y}$.

Atque his Exemplis arbitror, me omnem, quæ dari poſſet, Caſuum varietatem complexum eſſe. Cæterùm non erit fortaſſe inutile, ſi ea quæ generatim expoſui, ad lineam aliquam ſingularem applicem. Data ſit igitur Curva BD, cujus ea ſit proprietas, ut ſumpto in illa quolibet puncto D, ſi jungatur BD, & erigatur ad illam normalis DE, occurrens rectæ BE in E, recta DE ſit ſemper æqualis datæ rectæ BE. Ut habeatur Æquatio in terminis Analyticis, ſit $DA = v$, $BA = y$, BF vel $DE = q$. Erit itaque $EA = \frac{vv}{y}$. Et cùm quadratum DE æquale ſit duobus DA, AE; erit æquatio $qq = \frac{v^4}{yy} + vv$; ſive $qqyy = v^4 + yyvv$; quæ pro Tangente, ex Regulæ præſcripto, ſic reformanda erit, Fig.2.

$$qqyy - vvyy = v^4 + yyvv$$

$$2qqa - 2vvya = 4v^4 + 2yyvv$$

$$a = \frac{4v^4 + 2yyvv}{2qqy - 2vvy}.$$



Quomodo autem Æquationes hujuſmodi ad faciliores terminos pro conſtructione reduci debeant, id ſanè ſolertem Geometram minimè latebit. Ut ecce in hoc Exemplo, quoniam Rectangulum BAE ſupponitur æquale Quadrato AD, ſi EA dicatur e, erit $vv = ye$, & $v^4 = yyee$, & $qq = ye + ee$. Itaque pro illis, poſito in æquatione eorum valore, fit $a = \frac{4yyee + 2y^3e}{2eey + 2eyy - 2eyy}$, ſive $a = \frac{2ey + yy}{e}$, hoc eſt, $ae = 2ey + yy$ & addito ee utrinque $ae + ee = ee + 2ey + yy$. Erant itaque tres $e \mid e + y \mid e + a$, ſive EA, EB, EC, in continua analogia, & facillima evadet conſtructio.

Cæterùm, quoniam hactenus ſuppoſuiſſe videmur, Tangentem verſùs partes B ducendam eſſe, cùm tamen ex datis accidere poſſit, ut vel parallela ſit ipſi AB, vel etiam ducenda ad partes contrarias; definiendum nunc ſupereſt, quomodo hæc Caſuum diverſitas in Æquationibus diſtinguatur, Factâ igitur Fractione pro a, ut in Exemplis ſupra adductis, conſiderandæ ſunt partes tam Numeratoris quàm Denominatoris, & earum ſigna.

1. Nam ſi in utroque, partes vel habeant omnes ſignum +, vel ſaltem Affirmatæ prævaleant Negatis, ducenda erit Tangens verſus B.

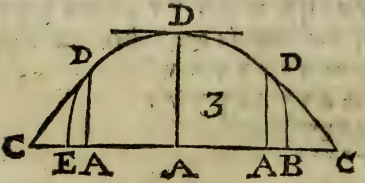
2. Si Affirmatæ prævaleant Negatis in Numeratore, ſed æquales ſint in Denominatore, recta per D ducta, parallela AB, tangit Curvam in D: hoc enim in caſu, a eſt infinitæ longitudinis.

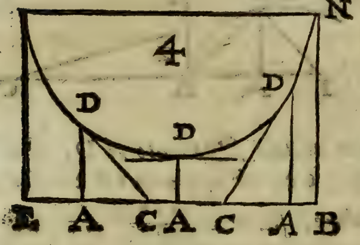
3. Si tam in Denominatore, quàm Numeratore, partes Affirmatæ minores ſint negatis; mutatis omnibus ſignis, ducenda erit rurſus Tangens verſùs B: hic enim caſus cum primo in idem recidit.

4. Si in Denominatore prævaleant, in Numeratore minores ſint, vel contra; mutatis ſignis illius in quo ſunt minores, ducenda erit Tangens verſùs partes contrarias, h.e. AC ſumenda erit verſùs E.

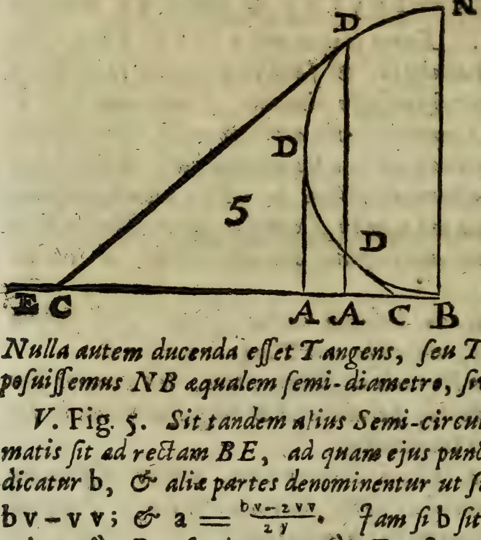
5. Ac tandem ſi in Numeratore partes Affirmatæ ſint æquales Negatis, quomodocunq; ſe habeant in Denominatore, a abibit in nihilum. Itaq; vel ipſa AD erit Tangens, vel ipſa EA, aut ei parallela; quod ex datis facilè dignoſcitur. Horum autem Caſuum varietas explicari poteſt per Æquationes ad circulum.

*Vid.*Fig.3. *Sit enim Semi-circulus, cujus diameter EB, & in eo punctum D datum, ex quo cadat normalis* $DA = v$. *Sit* $BA = y$, $BE = b$; *erit æquatio* $by - yy = vv$, *& ductâ Tangente DC, erit AC ſive* $a \frac{2vv}{b-2y}$. *Nunc ſi* b *major ſit* $2y$, *ducenda eſt tangens verſùs B; ſi æqualis, fit parallela EB; ſin autem minor, ducenda eſt verſùs E; ut n.* 1. 2. *&* 4. *diximus.*





*Vid.*Fig.4. *Detur rurſus alius Semi-circulus inverſus, cujus puncta referri intelligantur ad Rectam diametro parallelam, & eidem æqualem, ut in ſchemate. Denominatis, ut priùs, partibus, &* $NB = d$, *fit æquatio* $by - yy = dd + vv - 2dv$. *Igitur AC ſive* $a = \frac{2vv - 2dv}{b - 2y}$. *Cùm verò in exemplo ſuppoſuerimus,* v *ſemper eſſe minorem* d; *ſi* b *ſit major* $2y$, *ducenda erit Tangens verſùs E; ſi æqualis, erit parallela; ſin minor, mutatis omnibus ſignis, ducenda erit verſùs* b; *ut n.*4. 5. *&* 3. *Nulla autem ducenda eſſet Tangens, ſeu Tangens foret ipſa EB, ſi ſuppoſuiſſemus NB æqualem ſemi-diametro, ſive* $2d = b$; *ut n.* 5.



V. Fig. 5. *Sit tandem alius Semi-circulus, cujus diameter NB normalis ſit ad rectam BE, ad quam ejus puncta referri intelligantur. NB dicatur* b, *& aliæ partes denominentur ut ſuprà; fiet Æquatio* $yy = bv - vv$; *&* $a = \frac{bv - 2vv}{2y}$. *Jam ſi* b *ſit major* $2v$, *Tangens ducenda erit verſùs B; ſi minor, verſùs E; ſi autem æqualis, ipſa DA erit Tangens; ut n.* 1. 4. *&* 5to.

Et hæc eſt, ni fallor, Caſuum omnium varietas, quæ ex Æquationum conſideratione deprehendi poteſt.

Quomodo verò ex doctrina Tangentium conſtituantur Æquationum Limites, non eſt ut pluribus exponam, cùm evidens eſſe exiſtimem, maximam vel minimam applicatarum vel utramque ſimul determinari à Tangente parallela: de quo & aliàs ad Te ſcripſi, & aliquid etiam attigi

Miſcelaneorum cap; *ubi &, quâ ratione flexus contrarii curvarum ex Tangentibus inveniantur, oſtendi. Eadem ratione reperitur quoque μοναχὸς λόγος, ut vocat* Pappus, *& multa alia; quæ ſi explicare vellem, liber mihi ſcribendus eſſet. Nam & in Phyſico-mathematicis Uſus quoque hujus Regulæ opinione major eſt: Licèt enim falſum ſit Axioma,* Naturam agere per lineam breviſſimam; *veriſſimum tamen eſt, Viam ſequi determinatam, &, ubi nullam invenit, agere ἀορίστως. De quo aliàs plura, ſi tanti Tibi viſum fuerit: jam enim epiſtolæ modum exceſſi, ac vereor, ne, dum obſcuritatem vitare ſatago, in prolixitatem inciderim. Addo tantùm, me Regulæ meæ* Demonſtrationem * *habere facilem, & quæ ſolis conſtet Lemmatibus; quod mirum Tibi fortaſſe videbitur. Vale. Dabam* Leodii *d.* 17. Januar. *CIƆIƆCLXXIII.*

* Non dubitamus, quin rogatu noſtro Illuſtris & Candidus hic Author Demonſtrationem hîc indigitatam Nobis etiam brevi ſit communicaturus.

An Accompt of ſome Books.

I. *A Diſcourſe concerning the Origin and Properties of WIND, &c. By* R. Bohun *Fellow of N. Coll. in Oxon. Printed at* Oxford 1671. *in* 8°.

THe Induſtrious Author of this Diſcourſe, having conſider'd with himſelf, how little Progreſs had been made, as in general, in the *Hiſtory* of *Nature*, ſo, in particular, concerning the Hiſtory of *Winds*, till our Voyages to the *Eaſt* and *Weſt-Indies*, and the great advancement of Navigation in this and the precedent Age, furniſh't us with ſo many new Diſcoveries and Improvements in all Natural knowledge, eſpecially in the Motions of the *Winds* and *Seas*, that we muſt acknowledge the Inſufficiency of the Theories received from the Schools of the Antients; having, I ſay, conſidered this, and withall met with frequent opportunities of converſing with the moſt Experienced of our Sea-Captains, giving him good information of the Courſe of the *Trade-winds*, the *Indian Monzoons*, the ſeveral ſorts of *Briſes* in the African and American Climates, *Hurricans*, and other tempeſtuous Winds: Endeavoureth in this Diſcourſe to give a fuller Accompt of this Subject than former Writers have done; proceeding therein, as he aſſureth the Reader, with great caution, in ſeldom making uſe of any Account of Voyagers, but when ſeveral Relations did agree in the ſame Particulars, or when he

found the Relators to be perſons of un-ſuſpected Integrity: Occaſionally adding diverſe Philoſophical Reflections, in which he adhereth not to any one *Hypotheſis*, but maketh uſe of ſeveral, as they to him ſeem to ſerve beſt for the Explication of the preſent *Phænomena*.

1. Then, he diſcourſeth of the Opinions of the Antients, and compareth with them the Placits of the Moderns, conſidering *Wind* to be a Senſible Motion or Protruſion of the Air.

2. He examins the *Local Origins* of Wind, and compriſeth them under Three general Heads; as generated 1. In the *Lower Region*, by the Dilatation of Vapours or Air; by a ſurcharge of the Atmoſphere; by the Preſſure of Clouds, or the Elaſtical power of the Air. 2. From the *Earth* or *Seas*, as from Sub-marine or Sub-terraneal Eruptions; where he gives divers Hiſtorical Inſtances of Winds breaking from under the Earth or Sea, and particularly of the famous *Maſcarets* in the River of *Dordogne*, and the ſudden Tumors in the Lake of *Geneva*. 3. By *Deſcenſion* from the *Midle Region*; where he makes their Gravity to be the Cauſe of their Deſcent, not their Repulſe from the *Antiperiſtaſis* of Contraries.

3. He ventures to explicate the Fluxes and Refluxes of the Air and Winds, and their Motions to ſeveral Quarters, and that, by the moſt Violent Impulſe made that way where they find the *medium* moſt yielding, and fitteſt to propagate their motions.

4. He gives the reaſon, why ſome winds blow with greater violence than others; obſerving, that thoſe which are neareſt their *Local Origins* blow hardeſt, eſpecially ſuch as are re-inform'd by other auxiliary vapors as they paſs.

5. He conſiders the *Eſſential Attribute* of Winds to be their *Tranſverſe* Motion, and inquires into the various Cauſes of the ſame; diſcourſing withall of the other *Secondary* Affections of Winds; as their *Undulation*, *Repercuſſion* from Promontories, *Oppoſition*, *&c.* Where he

endeavors to explain, how it comes to paſs, that one Wind blows on the Top of a Mountain, and a quite contrary in the Vally below; and why in the main Sea, Winds keep the ſame Quarter a long time, but near mountainous Iſlands or Shoars they whiſtle up and down, and ſhift from one point of the Compaſs to another; Obſerving alſo, that ſometimes Contrary winds do rencounter together, and that by their ballancing one another a Calme enſueth.

6. He treats of the *Matter* of Winds, their *Limits* and Extent, and the *moſt Windy* Seaſons; giving an account, why they blow more in Spring and Autumn, than at other times.

7. He proceeds to the Hiſtory of the *General* or *Trade-wind*, alledging the Cauſes why it blows conſtantly from the *Eaſterly* points, and imitates the Courſe of the Sun: Inſtructing us withall, where it is to be expected on this ſide of the Tropique; as alſo of the Variation thereof in ſeveral *Longitudes*, and the Cauſe of the blowing of the *Weſterly* winds *without* the Tropiques.

8. He treats of *Provincial* winds, ſuch as wander not far from their native fountains, and terminat in thoſe Regions that gave them birth.

9. He gives the Hiſtory of the *Land* and *Sea-Briſes*; when they come in, or ceaſe, in the *Straights*, on the Coaſts of *Guiny*, and the *Eaſt* and *Weſt-Indies*; and what Accidents haſten or retard their approach.

10. He diſcourſes of the *Anniverſary Winds*; their ſeveral ſpecies, and particularly thoſe in the way to the Eaſt-Indies, called the *Monſoons*: How many months they continue the ſame Courſe on the Coaſt of *Afrique* and *India*; together with the Changing and Breaking up of the *Monſoons*, and the danger there is then at Sea when they do ſo.

11. He examins the *Qualities* of Winds, derived from their *Conſtituent Parts*, or the *Medium* they paſs through. Where he deſcends to the Conſideration of the Properties of *Eaſterly*, *Southerly*, *Weſterly* and *North*-winds; inſerting

divers remarquable Obſervations concerning them, and giving a Caution withall, to be uſed in Judging of the Qualities of Winds. Here alſo come in his remarques concerning *Hot* and *Cold* Winds, and the examination of their Cauſes; concluding this Head not only with obſerving ſome *Unuſual* Qualities of Wind, and the different odd Impreſſions they make upon other Bodies; but alſo delivering ſome propoſals, for a more accurate Diſcovery of the Nature and Qualities of Winds, in relation to Navigation, Architecture, and ſeveral Trades and Mechanical Arts.

12. He inquires into the *Prognoſticks* of Winds, from the different Appearances of the Celeſtial Bodies, from the Roaring of the Sea, the Reſounding of Echo's, the peculiar Actions or Paſſions of ſome Living creatures, &c.

13. He ſubjoins an Hiſtorical account concerning *Whirlwinds* in general, and *Tornados*, *Hurricans*, and other Tempeſtuous Winds; concerning which he delivers ſeveral uncommon and very remarkable Relations.

As to the whole matter, He is well aware, that it Will be hard to lay down any perfect *Theory* of Winds, in regard that the great *Inequalities* in the Superficies of the Earth; the ſeveral Obſtacles and *Repercuſſions* from mountains; the different Situations of the places and *Mediums* in which they blow; the Diſtance of thoſe Countries from the Poles of the World; their *Reſpects* to the Courſe of the *Sun*, whether they comply with, or reſiſt, the *Natural Motion* of the Air from Eaſt to Weſt, &c; have many intricate and nice ſpeculations, not eaſie to be ſtated.

II. *Deux Machines propres à faire les* Quadrans, *avec tres-grande facilité; par le P.* Ignace Gaſton Pardies S. J. *A Paris* 1673. *in* 12°.

THe Learned Author, Profeſſor of the Mathematiques in the Pariſian College of *Clermont*, having found, that the difficulty, met with in the *Practick* of *Dyalling*, and in that tedious train of divers operations that are to be made in following the common method, generally taketh away the pleaſure that would be in the exerciſe of a work that elſe is ſo curious and uſeful; is of opinion, that thoſe Inventions will be much eſteem'd, that ſhall make this practiſe eaſie. And in order thereto, he deſcribes and explains in this Tract two *Engines*, which to him ſeem very proper for that purpoſe; foraſmuch as he finds, that by the means of them a man may learn in leſs than an hour the way of making all ſorts of *Dyals*, and may practiſe what he has learnt, as 'twere by playing, drawing them upon Walls and in his Chamber with the greateſt facility.

He adds, that we are not to imagine, that the Uſe of theſe Inſtruments is but ſuch a Mechanical Operation, where a man works blind-fold, not knowing what he doth: And he declares, that, as to *Operation*, thoſe Practiſes that are ſimpleſt and ſureſt are to be held the beſt and the moſt geometrical; and he is of opinion, that ſcarce any thing can be done with leſs trouble or with more certainty than by means of theſe Machines. But then, if the queſtion be, to learn the *Theory* of *Dyalling*, he believes not, that it can be better done than by the Uſe of theſe very Engins; wherein he affirms that the Learner may eaſily be made to underſtand the Reaſon of all the Operations, the Reſpect of the Horary lines to the Courſe of the Sun, the Sections which the Arches of the Signs do make, and, in a word, the whole Science Gnomonique.

The Deſcription and Explication of theſe Inſtruments doth ſo much depend upon the view of the Schemes, employed therein, that it cannot be well made without them: Which maketh us refer the Curious Reader to the Tract it ſelf, now come over, wherein the neceſſary Schemes are annexed to the Diſcourſe.

Advertiſement.

T*Here is now in the Preſs a Body of* Algebra *in* Engliſh, *recommended thereto by ſome of the Members of the* R. Society, *Compoſed by that known Mathematician of* London, *Mr.* John Kerſey. *This Mathematical Art being that, by which chiefly* Des-Cartes *rendred himſelf ſo famous, as did* Vieta *before him, and ſince many of the* Engliſh, French, *and* Dutch *Nation; but no Elements of it in an entire Body being yet well digeſted in the* Engliſh *Language: this skilful Author hath taken the pains of digeſting the choiceſt things of this Science, which lay diſperſed in ſundry Books, that are either very ſcarce and almoſt unprocurable, or very dear: A work, which, as it will doubtleſs prove very uſeful for all ſorts of Ingenious Students of the Mathematicks in* England, *eſpecially thoſe that are not acquainted with* Latin, French *or* Dutch *(in which Languages the Books of thoſe Sciences are moſtly extant,) ſo it cannot but redound to the honour of this Nation, to have that done, whereby even the uncommon and abſtruſer parts of Learning and Knowledge are laid open and made intelligible to all ſuch Capacities here, as are Lovers thereof.*

Now as *for the Encouragement of the* Bookſellers, *a conſiderable number of perſons have already ſubſcribed, how many Books of this Work they will take off for themſelves and their Friends;* ſo *was it thought fit, in this Tract to give further notice, that, though a good part of this Work be already printed, yet if any others ſhall be deſirous to ſubſcribe the* Paper, *printed by the Book-ſellers for ſuch Subſcriptions, they ſhall be ſtill received, addreſſing themſelves to* Thomas Paſſenger, *or* Benjamin Hurlock *(living upon* London-Bridge,) *the Undertakers of this Work, who will aſſure all Subſcribers, that they ſhall not pay by Three ſhillings ſo much for each Book, as they will be ſold for in any ſhop. The* Terms, *on which they are to have the Books, are;* $1\frac{1}{2}$ *pence a ſheet, which is the cheapeſt price; and the Money not to be paid but upon the Delivery of the Books. The whole will take up at leaſt* 170 *ſheets.*

To give the Curious a ſhort view of the Contents thereof; he will find in the

Firſt *Book; The four Species of Algebraic operations both in Integers and Fractions: The Rule of Three in Algebraic Quantities: The Extraction of Roots out of Simple Quantities, as alſo out of a Quadratic Quantity conſiſting of three Terms: The compleating of an Algebraic Square conſiſting of three Terms, when one is wanting; together with a Collection of eaſie Queſtions to exerciſe the preceding Rules: Of an Equation, and the Reduction of Equations: How to convert Analogies into Equations, and Equations into Analogies: The Reſolution of Simple Equations exercis'd in* 28 *Queſtions both in* Numeral *and* Literal *Algebra: The Reſolution of ſuch Compound Equations, wherein there are two different Powers of the Quantity ſought, and the Lower of thoſe Powers*

ers is the Square root of the Higher; together with 28 *Queſtions, exerciſing ſuch Compound Equations, reſolved alſo in both kinds of* Algebra: *Of Arithmetical Progreſſion, where Mr.* Oughtred's 20 *Queſtions upon that ſubject are explained.*

The Second; *The Compleat Doctrine of the Extraction of all kinds of Roots, both in* Numbers *and* Letters: *Of Geometrical Proportion: Theorems about Continual Proportionals; together with* 20 *Queſtions about the ſame, reſolved by* Literal *Algebra: How to find out all the* Aliquot *parts or Juſt Diviſors as well of* Numbers *as of Quantities expreſt by* Letters; *and to find out the ſmalleſt Number that ſhall have a given Multitude of* Aliquot *parts: The Arithmetic of Surd Numbers and Surd Quantities, expreſt by* Letters; *where alſo of the nature and conſtruction of Binomials, and how to extract Roots out of them: An Explication of* Sim. Steven's *General Method of reſolving all manner of Equations in Numbers: Extractions out of* Vieta *and* Des-Cartes *for the like: The manner of reſolving Queſtions by putting a different Letter for every Quantity unknown, when many are ſought: The manner of reſolving Queſtions which have* Innumerable *Anſwers.*

The Third *Book is a Comment upon the hardeſt and choiceſt Queſtions, that are found in the ſecond, third, fourth, fifth and ſixth Books of* Diophantus *his Arithmetic; with other Queſtions of the like nature, invented upon the ſame Grounds by* Vieta, Bachet, Fermat, *and others.*

The Fourth *ſhews the* Uſe *of Algebraical Art in the Geometrical Reſolution and Compoſition of plane Problems,* viz *ſuch as may be effected by drawing only Right Lines, and deſcribing the Circumferences of Circles: Where the manner of finding out Theorems and Problematical Conſtructions, with their Demonſtrations by the ſteps of the Algebraic Reſolution, is clearly exhibited.*

Another Advertiſement.

There is a Book preparing for the Preſs, intituled SYNTAGMA MUSICÆ; in which the Eminent Author (John Birchenſha *Eſq;) treats of Muſick* Philoſophically, Mathematically, *and* Practically. *And becauſe the Charge of bringing this Book to the Preſs will be very great, eſpecially the ſeveral Cuts therein, with their Printing off, amounting by Computation to more than* 500 *l. beſides other great Expenſes for the Impreſſion of the ſaid Book, divers Perſons, for the Encouragement of the ſaid Author, have Advanced ſeveral Sums of Money; who for every* 20 *s. ſo advanced are to receive one of the ſaid Books fairly bound up; the Author engaging himſelf under his Hand and Seal to deliver to each of the Subſcribers, and Advancers of ſo much money, one of the ſaid Books at or before the* 24th *of* March 1674. *In which Excellent Work there will be.*

1. *A Diſcovery of the Reaſon and Cauſes of Muſical Sounds and Harmony: A compleat Scale of Muſick (never before perfected:) The Proportions of all Conſonant and Diſſonant Sounds, uſeful in Muſick, demonſtrated by intire Numbers (which the Author ſaith hath not been done by any:) The differing Opinions of Muſical Authors reconciled: Of Sounds gene-*

rated, and diffuſed in their Medium*: Of their difference to the Organ of Hearing; together with their Reception there, and wonderful Effects: Of the Matter, Form, Quantity, and Quality of Muſical Bodies or Sounds: That Muſical Sounds are originally in the Radix or Uniſon; and of their Fluxion out of it: Of the General and Special Kinds, Differences, Properties and Accidents of Sounds: Of the Truth and Falſhood of Sounds.*

2. *Of the Principles of the* Mathematical *Part of Muſick: Of the Whole, and Parts of the Scale of Muſick: Of Sounds Equal and Unequal: Of the Numeration, Addition, Subtraction, Multiplication and Diviſion of Muſical Sounds: Of Muſical Proportions, and their various Species's: What a Muſical Body or Sound* (Mathematically *conſidered,* viz. *as Numerable,) is: Of Muſical Medieties,* ſc. *Arithmetical, Geometrical and Harmonical; together with* 8 *other Muſical Medieties, of which no mention being made by any Muſical Author: Of the Radix's of Muſical Numbers; and that by their Powers all thoſe Numbers, (and no other,) which demonſtrate the Proportions of Sounds, do ariſe: Of Muſick Diatonic, Chromatic, and Enharmonic: Of the Principles of a Muſical Magnitude, what and how manifold they are, and how they are conjoyned: Of the Contact, Section, Congruity, Adſcription of a Muſical Body: Of the Commenſurability thereof: In what reſpect a Muſical Sound may be ſaid to be Infinit, and how to bound that Infinity.*

3. *Of a Muſical Syſtem, Character, Voice, or Key: Of the Tranſpoſition of Keys: Of the Mutation of Muſical Voices: Of Muſical Pauſes and Periods: Of the Denomination of Notes: Of the Moods, and Intervals: Of pure and florid Counter-point: Of Figurat Muſick: Of Fuges, Canons, Double-diſcant, Syncope: Of the Menſuration of Sounds (called* Time*) and the Reaſon thereof: Of Choral Muſick, both* Roman *and* Engliſh*: Of the Rhythmical part of Muſick: Of the Solmiſation, and Reaſon thereof.*

4. *The Abſtruſe and Difficult Terms of this Science are explained: The unneceſſary and myſtical ſubtleties, into which the Cauſes both of the Theory and Practic of Muſick were reduced to the great obſcuring of this Art, are omitted: The Principles of Philoſophy, Mathematicks, Grammar, Rhetorick and Poetry, are applied to Muſical Sounds, and illuſtrated by them: The Generation of ſuch Sounds is diſcours'd of, and particularly demonſtrated.*

5. *An eaſie way is by this Author invented for making Airy Tunes of all ſorts by a* certain *Rule (which moſt men think impoſſible to be done,) and the Compoſing of* 2, 3, 4, 5, 6 *&* 7 *Parts; which by the Learner may be performed in a few months;* viz. *in two months he may exquiſitely and with all the Elegancies of Muſick compoſe two parts; in three months, three Parts, and ſo forward; as he affirms many perſons of honor and worth have often experienced; which otherwiſe cannot be done in ſo many years.*

6. *Whatſoever is grounded upon the ſeveral* Hypotheſes *and* Poſtulata *in this Book, is clearly demonſtrated by Tables, Diagrams, Syſtems, &c.*

ERRATA. P. 5132. l. 31. r. *theſe Veins.*

LONDON, Printed for *John Martyn*, Printer to the *R. Society*, 1672.

PHILOSOPHICAL TRANSACTIONS.

Febr. 24. 16$\frac{72}{73}$.

The CONTENTS.

A New Experiment of Mr. Boyle *concerning an Effect of the Varying Weight of the Atmoſphere upon ſome Bodies in the water; ſuggeſting a conjecture, that the very Alterations of the Air in point of Weight may have conſiderable operations even upon mens Sickneſs or Health. An extract of ſome Letters from Dr.* John Wallis *to the Publiſher, concerning the Suſpenſion of Quickſilver, well purged of Air, much higher than the ordinary Standard in the Torricellian Experiment. An Account of two Books:* I. *Obſervations Topographical, Moral, and Phyſiological, made in a Journey through part of the* Low Countries, Germany, Italy, *and* France, *&c. by* John Ray, *Fellow of the R. Society: whereunto is added, A brief Account of* F. Willoughby *Eſq;* *his Voyage through a great part of* Spain. II. Bernhardi Vareni M. D. *Geographia Generalis, aucta & illuſtrata ab* Iſaaco Newtono, *è* Soc. Reg. *An* Index *for the Tracts of the Year* 1672.

A New Experiment of the Noble R.Boyle, *concerning an Effect of the Varying Weight of the Atmoſphere upon ſome Bodies in the Water; the Deſcription whereof was preſented A.*1671. *to the peruſal of the Right Honourable the Lord* Brouncker; *as the Experiment it ſelf was ſince by the Author's favour ſhewn to the Publiſher.*

THough many things have by Ingenious men been already obſerved, as to the Power and Operations of the Atmoſphere's Weight upon Liquors that are expoſed to it in Torricellian Tubes (or other Veſſels cloſed at one end, and near the top either empty or unfill'd with any viſible Body;) yet men ſeem not to have much inquired what effects the very *Variation* of this weight of the Atmoſphere may have on the Liquors which it preſſes, in other Veſſels than ſuch as Baroſcopes and Pumps. And yet when I remember, how much of Air appears by our Engine to be inviſibly harbour'd in the Pores not only of Water, but of the Blood, Serum, Urine, Gall, and other Juyces of the Humane Body, and that (as I have elſewhere experimentally ſhewn) the Preſſure of the Atmoſphere and the Spring of the Air work upon Liquors and on Bodies immers'd in thoſe Liquors, as well as upon Solid ones immediately expoſed to the Air, I am prone to ſuſpect, that the very Alterations of the Atmoſphere in point of Weight may, in ſome caſes, have ſome not contemptible Operations even upon mens Sickneſs or Health; as when the ambient Air, for Inſtance, grows ſuddenly very much lighter than 'twas before, or than 'twas wont to be, the ſpirituous and aerial particles, that are plentifully harbour'd in the maſs of Blood, will naturally ſwell that Liquor, and ſo may diſtend the greater Veſſels, and not a little alter the celerity and manner of the Circulation of the Blood by the Capillary Arteries and Veins. By which alteration that divers Changes may happen in the Body, will not ſeem improbable to thoſe that know in general, how important a thing the manner of the Circulation of the Blood may be there, though as to its particular Effects I leave them to the ſpeculation of Phyſitians; and ſhall only add, that to keep this Conjecture of mine (for I propoſe it as no other) from ſeeming as groundleſs as extravagant, I will annex an Experiment that you will not perhaps diſlike, juſt as I find it regiſter'd among ſome of my looſe Papers.

I cauſed to be blown at the flame of a Lamp three ſmall round Glaſs-bubbles about the bigneſs of Hazel-nuts, and furniſh'd each of them with a ſhort and ſlender ſtem, by whoſe means they were ſo nicely poiſed in water, that a very ſmall change of Weight would make them either emerge, if they but lightly leaned on the bottom of the Veſſel, or ſink, if they floated on the top of the Water.

This being done at a time when the Atmoſphere was of a convenient Weight, (and ſuch a ſeaſon is not ordinarily difficult to be choſen within ſome reaſonable time to him that wants neither attention nor a good Baroſcope) I put them in a wide-mouth'd Glaſs furniſh'd with common Water, and leaving them in a quiet place, where yet they were frequently in my eye, and were ſuffer'd to continue many weeks (or ſome months,) I obſerved, as I expected, that ſometimes they would be at the top of the Water, and remain there for divers days, or perhaps Weeks; and ſometimes would fall to the Bottom, and after having continued there for ſome time (longer or ſhorter) they would again emerge. And though ſometimes (eſpecially if I removed the Veſſel that contain'd them to a Southern Window,) they would riſe to the Top or fall to the Bottom of the Water, according as the Air was hot or cold; yet 'twas not difficult to diſtinguiſh thoſe motions from thoſe produced by the varying Gravity of the Atmoſphere. For when the Beams of the Sun, or heat of the Ambient Air, by rarifying the Air included in the Bubbles, made that Air drive out ſome of the Water, and conſequently made the whole Bubble (conſiſting of Glaſs, Air and Water) ſomewhat lighter than a bulk of Water equal to it, though the bubble did neceſſarily ſwim as long as the included

Air

Air was thus rarifyed, yet when the abſence of the Sun, or any other cauſe made the Air looſe its Adventitious warmth, there would enſue a Condenſation of the Air again, and thereupon an Intruſion of more Water (to ſucceed the Air) into the Glaſs, and conſequently a ſinking of the Bubble, and this would commonly happen at night, if it did not happen ſooner. But when 'twas upon the account of the Varying Weight of the Atmoſphere that the Bubbles either roſe or fell, it appear'd by the Baroſcope, that the Atmoſphere was ſo heavy or ſo light, that they ought to do ſo. Inſomuch that I divers times predicted, whether I ſhould find the Mercury in the Baroſcope high or low, by obſerving the ſcituation and poſture of the Bubbles; and conſulting that Inſtrument, it verified my Conjectures. And though, whilſt the Atmoſphere was not too conſiderably either light or heavy, the Changes of the Air as to Heat or Cold, would (as I was ſaying) place the Bubbles ſometimes at the top and ſometimes at the bottom of the Water, within the compaſs of a day; yet if the Atmoſphere were either very heavy or very light, the bubbles would continue at the bottom or at the top of the Water for many daies together in caſe the Atmoſphere did not in all that time change its Gravity. And I remember, that I did, for curioſities ſake, when the Quickſilver was high in the Baroſcope, put the Glaſs two or three daies in a South-window about Noon (and for a good while after) and that in Sun-ſhining weather, and yet even then the Bubbles did not emerge, though it appear'd by a good ſealed Weather-glaſs, which I kept in the ſame Window, that the ambient Air was much warmer than at other times, when I had obſerved the Bubbles to keep at the top of the Water.

N B. 1. It being very difficult to poiſe ſeveral Bubbles preciſely, as well one as another, I thought it not ſtrange, that all the three Bubbles did not conſtantly (though for the moſt part they did) riſe and fall together, but ſometimes two of them, and now and then (though ſeldome) one alone would ſink or emerge, when the change of the weight of the Atmoſphere was not conſiderable enough to operate ſenſibly upon the reſt (and of ſuch Inſtances I have had opportunity to obſerve one or two within theſe laſt three daies:) And therefore 'tis not amiſs, to poiſe a greater number of Bubbles together, that, after tryal made of all, the fitteſt may be choſen. Which Advertiſement will appear the more proper, becauſe of what is to be added in the following Note.

2. I have obſerved it ſometimes to happen, that a Bubble, that floated when 'twas firſt poiſed, would after a while ſubſide without any manifeſt Cauſe, or if it were made to ſink by ſuch a cauſe, it would continue at the bottom of the Water, though that cauſe were removed: Which difficult Phœnomenon ſeeming to depend upon a kind of Imbibition made of certain Particles of an Aereal Nature by the Water, the conſideration of it belongs to another place, not to this; where it may ſuffice, that the experiment did ſometimes actually anſwer expectation as that above-related did; wherein my main drift was to ſhew, that ſince, as the Atmoſphere is heavier or lighter, 'tis capable to work upon Bodies under Water ſo as to procure their ſinking, or their emerſion; the Air (though a fluid a thouſand times lighter) muſt lean or preſs upon the Water it ſelf, by whoſe intervention it produces theſe effects; which confirms what I elſewhere teach, that the Atmoſphere is incumbent as a heavy Body upon the Terraqueous Globe.

3. Beſides the other Circumſtances, upon whoſe account this Experiment may fail of ſucceſs, the ſeaſon of the Year, wherein 'tis tryed, may, for ought I know, be conſiderable. For which reaſon I ſhall here add this Advertiſement, That I chooſe, but do not confine my ſelf, to make my Tryals about the beginning of the Spring, as a time wherein notable alterations of the Air, as well as to Weight, as to other things, are the likelieſt to be frequent.

So far this Experiment, which upon this occaſion is likely to be improv'd unto a kind of Baroſcope; *which, together with an* Hygroſcope, *may be expected ere long from the ſame hand.*

An Extract of Letters from Dr. John Wallis *to the Publiſher,* 1672.Sept.26.&c. *concerning the Suſpenſion of Quickſilver well purged of Air, much higher than the ordinary Standard in the Torricellian Experiment.*

SIR,

I Am not ſorry to find, in your *Tranſactions* for the laſt Month,(which I have newly received,) that M. *Hugens*, an Ingenious and Inquiſitive perſon, doth endeavour to give a Reaſon of that Odd *phænomenon* in the Torricellian Experiment(obſerv'd by my Lord *Brouncker*,and Mr. *Boyle*, many years ſince, in purſuance of an Order of the *R.Society* to that purpoſe,) of which I give an account in my Treatiſe *De Motu Cap.*14.*Schol.prop.*13. The Phænomenon is this:

Whereas in the Torricellian Experiment,the Quickſilver contain'd in the Inverted Tube, how long ſoever, whoſe open orifice C. is immerged in ſtagnant Quickſilver, does uſually fall down to the height of about 29. inches above the ſurface of the ſtagnant Quickſilver AB, and there remains ſuſpended,as at I: If the Quickſilver be well cleans'd from Air, it has beed found to ſtand top-full, much higher, even to the height of 75. inches (and how much higher it may ſtand, we cannot tell;) but upon the admiſſion of the leſt Air, or a concuſſion of the Tube, it falls down to the uſual ſtandard. *See the Fig.*

Two Reaſons I did there hint (though not perfectly ſatisfied in either:)The *one*,of my own,concerning the Spring of the Air, neceſſary to put Heavy bodies in motion, not impell'd by any other force: The *other*,of my L.*Brouncker*, that there might be in the Air yet a greater Weight or Preſſure than is neceſſary for the height of 29 inches, in caſe there be nothing but the bare weight of Quickſilver to be ſupported.

I find, Monſieur *Hugens* to fall in with that of my Lord *Brouncker*, ſave that what we comprehend under the name of *Air*, he calls a *more ſubtile Matter:* which alters not the Caſe at all, but only the Name.

By *Air*, I find, Mr. *Hobbes* would ſometimes (as in *Dialogus Phyſicus* p. 4.) have us underſtand a *pure Æther*, or (as his words are) *Aerem ab omni Terræ Aquæq; effluviis purum, qualis putatur eſſe Æther*; to which, I ſuppoſe, anſwers the *Materia ſubtilis* of *Des Cartes*, and Monſ. *Hugens* his *more ſubtile Matter* than *Air*. On the other hand, M. *Hugens* here, by *Air*, ſeems to underſtand that feculent matter ariſing from thoſe the *Earths and Waters Effluvia*, which are intermingled with this *ſubtile Matter*. We mean by *Air*, the *Aggregate of both theſe*, or whatever elſe makes up that *Heterogeneous Fluid* wherein we breath, commonly called *Air*; the purer part of which is Mr. *Hobbes's Air*; and the feculent of it is Monſieur *Hugens*'s *Air*.

And therefore, where I ſpeak of *Vacuity* caus'd by the Torricellian Experiment, or ſuch other ways, I do expreſly caution (*De Motu C.* 14. and *Hobb. Heaut. p.* 152. and elſewhere,) not to be underſtood as affirming *Abſolute vacuity* (which whether or no there be, or can be in nature, I liſt not to diſpute;) but at leaſt an Abſence of that *Heterogeneous mixture which we call Air*, *ſuch as that is wherein we breath*; without diſputing againſt the *purus Æther* of Mr. *Hobbes*, or the *Materia ſubtilis* of *Des-Cartes* or M. *Hugens*; as not neceſſary to the Inquiries in hand.

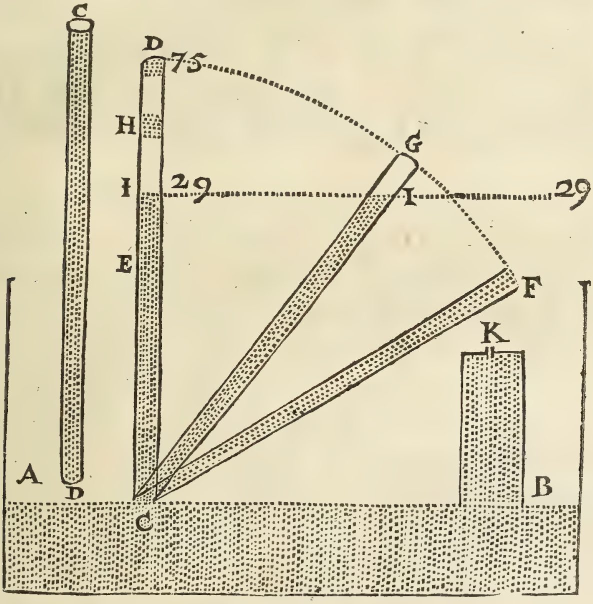
To the Preſſure of this Purer matter (which they ſuppoſe ſo ſubtile, as to penetrate the Mercury, Marble, and Glaſs it ſelf,) they adſcribe the Suſpenſion of the Quickſilver to ſo great an height. And my Lord *Brouncker* in particular, while that Piece of mine was under the Preſs, had a deſign (as He then ſignified to me) of proſecuting the Experiment (as Monſieur *Hugens* does now adviſe,) to ſee if he could bring it to ſome Determination (of which I might there have given an account, if it could have been diſpatcht time enough;) what were the utmoſt height at which it might be thus made to ſtand; thereby to determine the preſſure of this Purer matter, as that of the Common Air is determin'd by the Torricellian Experiment. But his leiſure not then ſerving, I only gave that brief account of his

Notion, as it is there inſerted: And, whether he have ſince had leiſure, amidſt a great preſs of other buſineſs, to purſue it, I am not certain.

Now, though I would not wholly exclude this, if ſuch ſhall be found to be (but only ſuſpend my Aſſent till it be evinced;) yet ſurely there muſt be ſomewhat more in it than that of this Subtile matter, to ſolve the *Phænomenon*, notwithſtanding the two Experiments now alledged by M. *Hugens* in favour of it. For, if this Matter be ſo ſubtile as to preſs, through the top of the Glaſs, upon the Quickſilver (and conſequently through the upper upon the neather of the *two-Marbles*,) as is acknowledged; (and without which it is no more able to precipitate the Quickſilver while impure, and when it is in part ſubſided, than when it is pure, and the Tube top-full :) I do not ſee, why it ſhould not balance it ſelf (above and below) in the ſame manner as Common Air would do, if the Tube were pervious to it at both ends, and the Quickſilver, by the preponderance of its own weight, fall preſently.

And the *Anſwer*, That, though the Glaſs be penetrated by it, yet not in ſo copious a manner as where no Glaſs is; doth not, to me, ſolve the difficulty: Becauſe the ſame obſtacle doth juſt in the ſame manner remain, when the Tube is in part emptied; and, when the Quickſilver is un-purged: the pores of the Glaſs not being, by either of thoſe, made more open or more pervious. And if we ſuppoſe the Subtile matter by percolation to be ſtrain'd through, with ſome difficulty, (as Air or Water would be through a cloth,) this might poſſibly cauſe the Quickſilver, when it does ſink, to ſink *gradually*; but not (as we ſee it,) *ſuddenly* to fall to the height of 29 Inches; as from D to I.

The Connexion or Cohæſion of the parts of Quickſilver, either each to other, or to the ſides of the Glaſs, which Mr. *Hugens* ſuppoſeth to require for their ſeparation a greater force, than is in theſe percolated particles till they have room made for them to combine; ſeems to me the leſs conſiderable, becauſe it is not ſo neceſſary to ſeparate them from each other, ſince that they may un-ſeparated ſlide down by the ſides of the Glaſs; to which, it is well known, and viſible to the eye, the Quickſilver is not at all apt to ſtick, but doth rather decline that contact; in like manner as we find Water not apt to Joyn with Oyle or Greaſe; though Water to Glaſs, and Quickſilver to Gold, do very readily apply themſelves. So that there needs no ſuch Force to diſjoyn the Quickſilver from the Glaſs, whatever there may be for diſ-joyning its parts one from another.



If therefore we ſhould ſuppoſe the preſſure of the *Groſſer* Air downwards on AB (the ſurface of the ſtagnant Quickſilver,) and conſequently, by means thereof, upwards at C, ſufficient only to bear up that in the Tube to the height of I; but the ſuper-added weight or preſſure of the *Purer* Air to hold it up as high as D (75 inches or more,) while it is full, and the Quickſilver well cleans'd; as if ſo long it could not enter at D; but in caſe it be not ſo cleanſed, or be already ſunk to H, this *purer* Air would enter at D, and thruſt it downto I, counterballancing the preſſure (at C) of the purer but not of the groſſer Air (which I take to be the ſum of the Cauſe aſſign'd by M. *Hugens:*) I am yet to ſeek, why it may not as well penetrate D at firſt to begin the Deſcent, as afterwards to purſue it; and, why not as well begin the Deſcent when the Quickſilver is well cleanſed of Air, as when it is not ſo; and why alſo, if the *pure* Air do freely enter at D, it does not preſently fall; or, if not freely, why, when it does fall, it falls ſuddenly and not leiſurely from D to I; eſpecially ſince ſo ſmall a weight as D H of pure Air (for the groſſer cannot enter,) is very inconſiderable; if not at all, or not freely, preſſed by *that* incumbent on D; and the Adheſion not conſiderably leſs, by being ſeparated only at the Top, while it yet continues to touch the ſides.

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I am apt therefore, as heretofore, to adſcribe the *Cauſe* of this *Phænomenon* to the Spring that is in Air, and the want thereof in Quickſilver. For, that in Air there is a Spring or Elaſticity, is now undoubted; but in Water, cleans'd of Air, though many Experiments have been attempted to that purpoſe, it has not yet been found that there is any: And I am apt to think the like of Quickſilver; though I do not know, that this has been yet ſo rigorouſly examin'd. Now ſuppoſing, that Matter, being at Reſt, will ſo continue till it be put in motion by ſome Force; this force may be *either* that of *Percuſſion* from ſome Body already in motion (which is the Caſe, when the Quickſilver falls by ſhaking or ſtriking the Tube;) *or* of *Pulſion*, from a contiguous Body beginning to move, as by the Expanſion of ſome adjacent Spring (which is the Caſe, when the Springy parts of the Air, either left in unpurged, or re-admitted in the Quickſilver, by expanding themſelves put the Quickſilver in motion;) *Or* ſome *Conatus* or Endevour of its own; ſuch as is that of a Spring (from whatever cauſe it be, which I do not here inquire,) but has place only in Springy bodies; and therefore if Water and Quickſilver be not ſuch, they will not on this account put themſelves in motion.

Gravity or Heavineſs is, I know (if we knew what it were,) reputed to be ſuch a *Conatus* or Pronity to move downwards, and ſo to put it ſelf in motion: And the wonder at preſent is, why it does not ſo here. But if this, which we call *Gravity*, ſhould chance to be not a Poſitive quality or *Conatus* originally of it ſelf, but only the Effect of ſome Pulſion or Percuſſion from without, (which poſſibly may be the Caſe, and principally from the Spring of the Air about us;) then, while this Pulſion and Percuſſion is wanting (however obviated,) the Bodies, accounted Heavy, will not of themſelves begin to fall: which ſeems to be the preſent Caſe.

And this is the more conſiderable, becauſe we cannot (at leſt not yet) find, what is the Utmoſt height at which the Quickſilver thus accumulated will remain ſuſpended; there having been (for ought I know) no height yet attempted, at which, if cleanſed, it will not ſtand; and that of 75 inches, conſidering the weightineſs of Quickſilver, is a very great one, being more than equivalent to 80 foot of water.

My Lord *Brouncker* doth a little alter the caſe, from what I take to be the Hypotheſis of Monſieur *Hugens*. For he ſuppoſeth this *purer* part of the Air to be of like nature with the *groſſer* part, (which I think M. *Hugens* doth not;) and, though finer than the reſt, ſo as to penetrate Glaſs, which the groſſer will not (there being in all ſorts of grains, ſome greater than others, and which will not paſs ſo fine a Sieve;) yet of a Springy nature, as the *groſſer* parts are: Which therefore acts, not by its *Weight* only, but by its *Spring*; and therefore when once entred, though in a ſmall proportion, acts as effectually, at its firſt entrance, as if the whole incumbent Air had admiſſion; its Spring being of a like tenſure with that of the outward Air; (as I have heretofore ſhewed *Cap.* 14. *De motu prop.* 11, 12, 13:) But M. *Hugens*'s more Subtile matter than Air though he muſt allow it Weight (for elſe its entrance would be nothing to the purpoſe,) yet whether he allow it a Spring, I cannot tell; nor doth he inform us. And when he ſays, this more Subtile matter than Air doth without difficulty penetrate Glaſs, Water, Quickſilver, and all other bodies, which we find impenetrable to Air; I know not whether he mean, without *any* difficulty (as the words ſeem to import,) or (as I conjecture by what follows) without *great* difficulty, though with *ſome.*

But his Lordſhip (if I miſtake not) though he allow his (Springy) Subtile matter to penetrate Glaſs, yet not without difficulty; and, till it have ſome room made (as HD) wherein it may recollect it ſelf, cannot exert its Spring, and therefore not while top-full of cleanſed Quickſilver; but, ſo ſoon as ſome room is made for it: Whereas, if the Quickſilver be not purged of Air, that little Air remaining doth by its Spring begin the motion.

He thinks it alſo not improbable (and if it ſo prove, it will be a good confirmation of this *Hypotheſis,*) that a large but low Tube of Glaſs (ſhorter than 29 inches) may ſtand top-full of Quickſilver, though with a ſmall hole in the Top, as at K; at leſt, if immerged in Water, in caſe Air be too Subtile for our Mechanicks.

He might alſo, ſuitably enough to his own Hypotheſis, have ſo explained himſelf, as to allow his more Subtile parts of common Air to penetrate Quickſilver, but not Glaſs; and therefore, in caſe of room for it at HD, it might through the Stagnant Quickſilver, and that at C, paſs upwards to HD, and there exert its Spring.

I ſhall forbear to diſpute againſt this Hypotheſis for the preſent; becauſe I think it more proper to examine by Experiment (which I think hath not yet been done,) whether well-purged Quickſilver may not be made to ſtand higher than CI, the ordinary ſtandard, ſuppoſe at CH, with a void ſpace about it, as HD. For the iſſue of this Experiment (amongſt others to be after mentioned,) ſeems very proper for determining of this doubt; which therefore I am not willing to pre-judge. There is yet another way of explicating the ſame Hypotheſis, without allowing this Subtile matter to pierce the Glaſs; which is this:

Our common Air being an aggregate of very Heterogeneous parts, we may well ſuppoſe ſome of them to be Springy, and others not to be ſo. The Springy parts we may conceive to be ſo many conſiſtent Bodies, like ſmall hairs or ſpringy threads wrapped up in different forms and variouſly intangled, and ſo as to form many vacuities capable of admitting (whatſoever other parts of the Air may be ſuppoſed to be) ſome Fluid matter, which may inſinuate into thoſe vacuities, (as water in a bundle of Buſhes,) without diſturbing the Texture of thoſe Springy parts; and which may preſs as a *Weight*, but not as a *Spring*, (of which diſtinction ſee *Cap.* 14. *De motu, Schol.prop* 11. *& Schol.prop.* 13. *pag.* 729, 730, 732, 733.)

Now if, in the Torricellian Tube, there be a quantity of ſuch Springy matter, the Spring hereof will be of equal ſtrength with that of External Air, (and therefore able to counterballance it, though its weight be much leſs,) becauſe admitted with ſuch a tenſure, (*ibid. prop.* 12, 13) But if only an Un-ſpringy Fluid (which preſseth but as a Weight not as a Spring,) and this defended by the glaſs-Tube from any other preſſure, ſave that of its own weight; it will ſtill be too weak to force its own way, till its ſingle weight be equivalent to that with which it is to encounter; which is, not onely the Springy part of the Air, but alſo that Fluid Un-ſpringy part; which though (becauſe Fluid) it would give way to a Springy body preſſing through it; yet not to this Fluid, like it ſelf, and deſtitute of ſuch a Spring; and is therefore able to keep it up to a much greater height than it could do if un-cleanſed of Springy Air: So long at leaſt as till ſome Springy body be admitted, or ſome concuſſion, equivalent to it, put it in motion; but being once in motion, it will ſo continue (as a Bullet impell'd by Gun-powder, or an Arrow out of a Bow,) till ſtopped by ſome Poſitive force equivalent.

I do not deny, but that this explication may be ſubject to ſome Difficulties and Exceptions; but I think, fewer than that of allowing the Glaſs penetrable by this Subtile matter.

But the beſt way to ſettle this buſineſs, being ſome ſuitable Experiments; I ſhould recommend (becauſe I am not ſo well accommodated for this purpoſe,) theſe, or ſome of theſe, Experiments, to thoſe of the *Royal Society*, who are in that kind better provided than I.

1.(That hinted by my Lord *Brouncker*,) Whether a large low Tube, of leſs height than the common Standard (of about 29 Inches *Engliſh*, or 27 Inches *French*,) might be made to ſtand top-full of Quickſilver, though a ſmall hole be left open at the Top; at leaſt under Water? I am apt to think, that it will rather ſink ſlowly and with a hiſſing noiſe, than fall ſuddenly and ſilently.

2. Whether of two poliſhed Marbles or metalline Plates, the lower will be found to ſtick to the upper, in the exhauſted Receiver, longer than is accountable for from the ordinary Counter-ballance in the Torricellian Experiment. For though Monſieur *Hugens* now, and Mr. *Boyle* (if my memory do not much fail me) have long ſince intimated this from his own Experience; yet I judge the Experiment worth repeating. And if it be (as I ſuppoſe it may) found to ſucceed, I ſhould think it may proceed from a want of a Spring or Elaſtick power between the Plates to force them aſunder; and in particular (ſince with this it hath been tryed) that Spirit of Wine is not a Springy body.

3. Whether a Siphon of unequal Legs will be made to run, in an exhauſted Receiver, with Water or Quickſilver, at a greater height than is accountable for; which though Monſieur *Hugens* have tryed it, I think it worth repeating in this *Society*. This when it doth ſucceed, I take to proceed from the Spring of that little remaining Air in the Receiver not quite emptied.

4.(Which ſeems of a like nature with the former,) Whether a Tube of greater length than 29 Inches, but ſo immerg'd as to be leſs than ſo much above the level, as CE, may not, if filled with well cleanſed Quickſilver, be gently lifted up with the Quickſilver in it, not only to I (as when it is unpurged) but to H or D, higher than the uſual Standard.

5. (Which is equivalent, but more eaſily adminiſtred,) Whether if ſuch a Tube, ſo filled, be at firſt ſo inclined (as CF) that its height above AB be leſs than 29 Inches, may not be leiſurely and gently erected, ſo as to remain full, not only to the height of I, but of G or D?

6. Whether cleanſed Quickſilver will, in the open Air, run in a Siphon higher that 29 Inches?

7. If not in the Air, whether it will ſo run, if the lower Leg open into well-cleanſed Water?

8. (Which I do principally recommend;) In a Tube ſo filled with cleanſed Quickſilver, as to ſtand top-full at a greater height than the uſual Standard, as CD; in caſe ſome part be forced out, not by admiſſion of Air but by Jogging the Tube, (I ſuppoſe as much as HD,) and a ſtop then made: Whether the reſt CH (at a greater height than I, the uſual Standard,) may be made ſo to ſtand of it ſelf, notwithſtanding the voidance of HD? For by this Experiment alone, if it ſucceed, it will appear, that it is not onely want of room for the Subtile matter to recollect it ſelf, which hinders the ſuſpended Quickſilver from falling; but rather (unleſs ſome probable cauſe can be found,) the want of a Spring to put it in motion. If it will not ſucceed, I ſhould rather think, the Springy Air doth make its way through the Quickſilver than through the Glaſs.

9. Whether cleanſed Quickſilver will remain ſuſpended in an inverted Tube (at leaſt a ſhort one, and with a ſmall Orifice,) though its Orifice C be no immerg'd in Quickſilver, but either in the open Air, or at leaſt in Water?

10. If ſo; then whether it will do the like, if, a little being forced out, there be ſome void room left at the Top, at HD?

Theſe are nice Experiments, and of ſome difficulty; but if carefully adminiſtred, may be of good uſe in our ſearch after the true nature of *Gravity:* Which may poſſibly have a greater connexion with the Spring of the Air, than men are aware of; ſince on the preſence or abſence thereof doth mainly depend the falling or not falling of

Bodies accounted Heavy. But I am not willing, by interpoſing my own Conjectures, to pre-judge the Experiments.

An Account of Two Books.

I. *Obſervations Topographical, Moral and Phyſiological made in a Journey through part of the* Low-Countries, Germany, Italy *and* France, *by* John Ray, *Fellow of the R. Society: Whereunto is added a Brief Account of* F. Willoughby *Eſq; his Voyage through a great part of* Spain. London, *printed for* J. Martyn, *Printer to the R. Society, at the Bell in St.* Pauls *Churchyard*, 1673. *in* 8°.

THis Curious and very Inſtructive *Itinerary* may well ſerve as a Pattern for Travelling with that improvement and advantage, as ought to be aimed at by all diſcreet Travellors; as containing whatever is remarkable both for Perſons and Things in thoſe places, which the Ingenious and Inquiſitive Author together with his good Company travelled through. Let his Reader be a States-man, an Eccleſiaſtick, a Philoſopher, an Artiſt, a Trades man, a Father of a Family, an Huſband-man; they will all of them find matter in this Book very proper for their reſpective Genius, Profeſſions and Callings. Here is deſcribed the Climat, Government, Revenues, Laws, Cuſtoms, Manners, Tempers, Abilities, Studies, Arts, Trades, and Natural Productions of the Countries ſpoken of; and beſides, divers Fabulous relations and ungrounded fancies refuted and rectified.

We ſhall only hint in this place the principal Heads of ſuch particulars, as belong to the purpoſe of *theſe* Tracts; in reference to which is to be noted what the Author obſerves,

1. Of the ſeveral Conſtitutions of Climats, and the difference, he found, between the Temperature of the *Air* on two oppoſite ſides of ſome Mountains.

2. Of *Waters*, as the moſt conſiderable Rivers and the Fiſhes bred therein; Of Springs, (the Original of which he diſcuſſeth,) ebbing and flowing Wells, *Spaw*-waters

(particularly thoſe about *Liege,)* Baths (eſpecially thoſe of *Aken* in Germany, and *Apona* in Italy ;) of Fountains boyling, and others yielding *Petroleum* near *Montpelier*,&c.

3. Of the *Earth*, and its Productions and Inhabitants: In which Head there occur;

j. Some Inſtances of Changes made in the Earth, as of Land gained from the Sea, and Mountains conſiderably diminiſht in height.

ij. Of *Minerals*,and particularly of Mines of Precious Stones,as Amethyſts,Emerauds,Topazes, Jaſpers,Granates, *&c.* obſerv'd in the Voyage into *Spain*; of petrified Shells, which Subjects he handles both largely and ingeniouſly.

iij. Of *Plants*, more eſpecially remarked by our Travellor in all the places where he paſſed, witneſs the particular *Catalogue* of them, annexed at the end of this Book.

iiij. Of *Animals*, as Inſects, Fiſhes,Birds,*&c.* concerning which the Author gives us good hopes of a more particular Account in the *Hiſtory of Animals*, prepared by that Worthy Gentleman Mr. *Francis Willoughby*, lately deceaſed to the unſpeakable grief of thoſe that knew him.

iiiij. Of the *Inhabitants* of the ſeveral Countries he was in: Where he deſcribes their Abilities, Inclinations, Manners, Studies, Exerciſes, Arts, Trades; giving a very particular deſcription of the *Italians* and *Spaniards*, and obſerving alſo ſome Peculiarities in People of ſeveral Countries, as,that ſome breed excellent Painters,Sculpters and Architects; ſome abound in Idiots and Delirous perſons above others; ſome are ſtored with Men and Women afflicted with ſwelled throats, *&c.* Taking alſo notice of the Academies and Colleges, and the Men eminent in them for Learning and Knowledge, as *Loven*, *Leiden*, *Heidelberg*, *Baſel*,*Nurenberg*,*Altorf*,*Padua*,*Bononia*,*Valence*,&c. Likewiſe of Libraries; of Cabinets or Repoſitories; of Natural Curioſities, particularly at *Delft*,*Heidelberg*,*Milan*,*Florence*, *Naples*,&c. Of notable Ædifices and curious Structures, as the extraordinary Steeple at *Strasburg* and the Church of St.*Peter* in Rome; of Whiſpering Places, Aqueducts and

Ventiducts; of remarkable Armories; of Artificial Contrivances, Inſtruments, Veſſels, Engins; as Locks to keep up water of any River for the uſe of Navigation; an Engin to raiſe Water with a chain of Buckets; a Veſſel at *Heidelberg* holding 600 Hogſheads; the *Spaniſh* Plough for ſowing Corn at equal diſtances, and one grain in a hole: Of Arts, Trades, Practices, Manufactures, as the Art of imitating China-diſhes at *Milan*, of poliſhing Jaſper, of making Moſaic Work and the compoſition of the Cement for it; of the practice of making Salt by the Sun, upon the Coaſt of the Mediterranean; the catching of Sword-fiſhes, Whales, Tortoiſes; of Coral-fiſhing; the making of Silks and Velvets; the Dying of Wool of an Incarnation colour, with a kind of Moſs growing in *Malta*; a peculiar fewel made at *Leige* of balls of Clay and ſmall beaten Coals; the Art of blanching Wax, making Venice-Sope, Verdigreece, Oyl-olive; of preparing and pickling of Capers; of drying Grapes for Raiſins; of making Confection of Alkermes; of making Sugar, Chocolata *&c.*

Every where are interſpers'd many curious Philoſophical Remarks; as, that more Air is neceſſary for Reſpiration in hotter Countries than cold, and why? The true reaſon of the raging of Fire in cold weather: Experiments of fulminating powder without any gold in it, together with the Receipt: The extremity of Cold ſcortching and tanning the face, as well as exceſs of Heat; and many more, for which we muſt refer the Reader to the Book it ſelf.

II. Bernhardi Vareni *M.D. GEOGRAPHIA Generalis; in qua affectiones generales Telluris explicantur ſummâ curâ quamplurimis in locis emendata, & XXXIII Schematibus novis, ære inciſis unà cum Tabulis aliquot, quæ deſiderabantur, aucta & illuſtrata ab* Iſaaco Newtono *Matheſ. Profeſſore Lucaſiano apud Cantabrigienſes, è* Societate Regia. Cantabrigiæ 1672. *in* 8°.

Errata left uncorrected in N°. 90.

Pag. 5140. l. 14. del. *for.* ibid. l. 24. r. *top-leaves.* p. 5141. l. 4. r. *Weather* ibid. l. 5. r. *Dearths.* p. 5142. l. 26. r. *of wheat.* p. 5144. l. 11. *data fuiſſet.* ib. l. 16. r. $3byya - 4y^3a$. ib. l. 19. r. Ut $yv, yyvy^3vv$. ib. l. 29. r. *latere ſiniſtro.* ib. l. 35. r. $\frac{6qqv^3 - 3yyv^3}{5y^4 + 4by^3 + 2v^3y}$. p. 5145. l. 6. r. 2qqya. ib. l. 17. r. *erunt itaque.* p. 5146. l. 28. r. *verſùs B.* ib. l. 32. r. *normalis.* p. 5147. l. 11. r. *Lemmatibus paſſim notis.* p. 5149. l. 5. r. *Whiffle-up and.* p. 5154. r. *deference.*

London, Printed for *J. Martyn* printer to the *Royal Society*, 1672.

BRITISH MUSEUM NATURAL HISTORY

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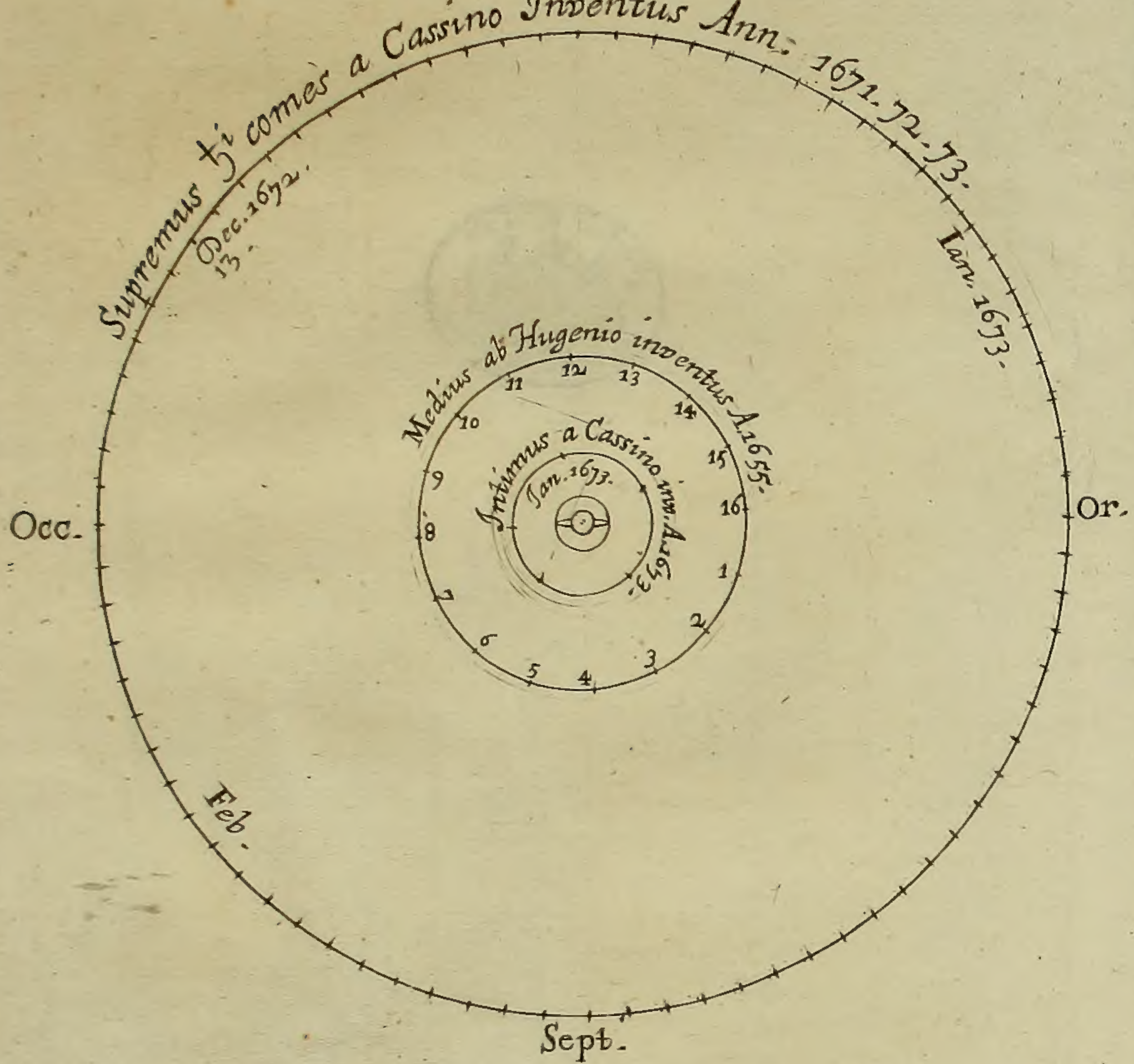
Planetæ noui circa ♄ ex Reg° Obseruat° detecti. cum vetere intermedio.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Ian. 1673.
Medius ab Hugenio inventus A. 1655.
Intimus a Cassino inv. A. 1673.
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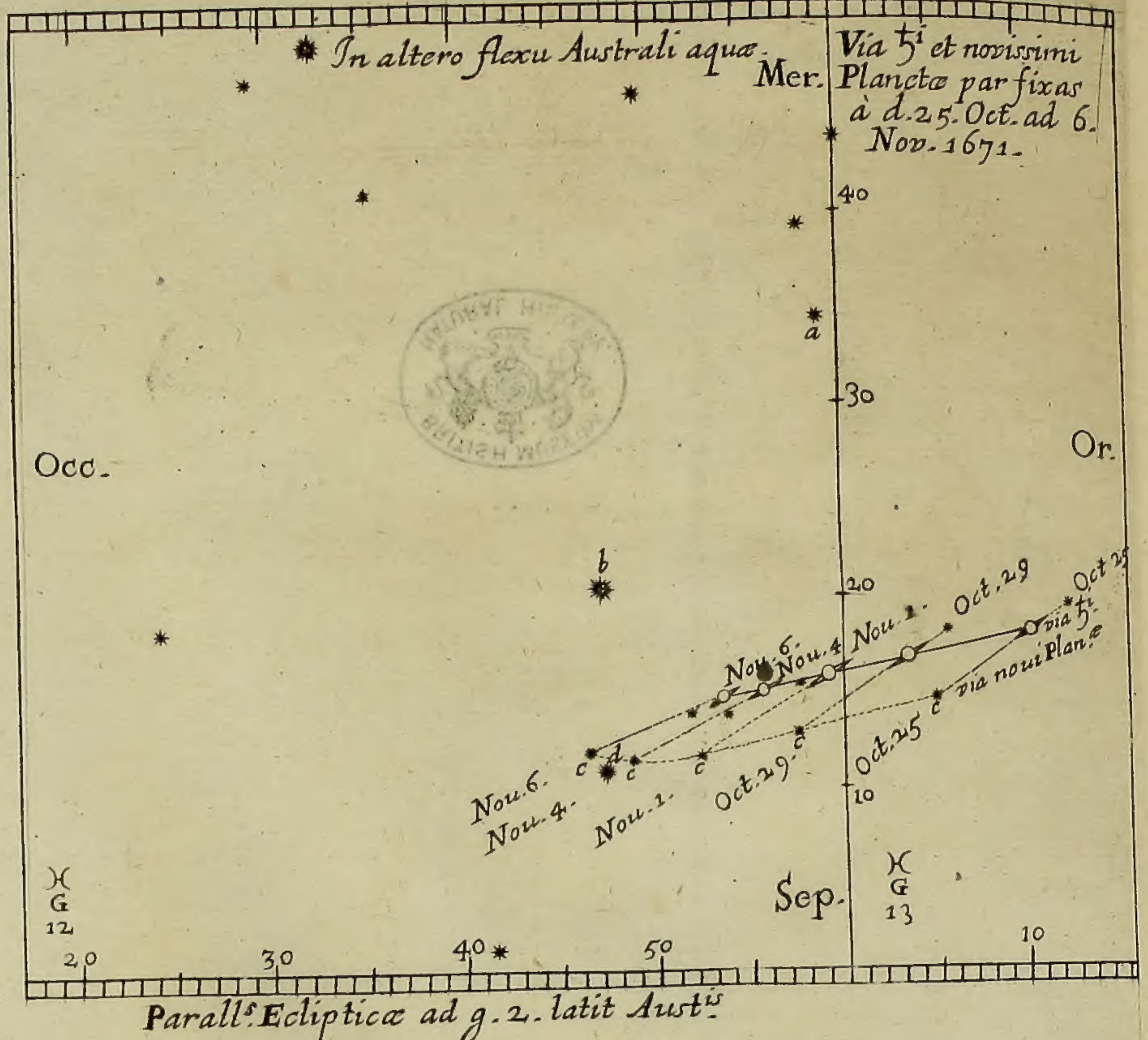

PHILOSOPHICAL Tranſactions:

GIVING SOME

ACCOMPT

OF THE

Preſent Undertakings, Studies and Labours

OF THE

INGENIOUS

IN MANY

Conſiderable Parts

OF THE

WORLD.

VOL. VII.

For the Year MDCLXXII.

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